KARADENIZ TECHNICAL UNIVERSITY * THE INSTITUTE OF SOCIAL SCIENCES

DEPARTMENT OF WESTERN LANGUAGES AND LITERATURE

MASTER’S PROGRAM IN APPLIED LINGUISTICS

THE DEVELOPMENT OF CORPUS-BASED GENRE-SPECIFIC WORD LIST AND THE SELF-STUDY MATERIALS FOR EAP TEACHING: THE CASE OF METALLURGICAL AND MATERIALS ENGINEERING

MASTER’S THESIS

Bera Taragay KARAOĞLU

SEPTEMBER - 2025

TRABZON

KARADENIZ TECHNICAL UNIVERSITY * THE INSTITUTE OF SOCIAL SCIENCES

DEPARTMENT OF WESTERN LANGUAGES AND LITERATURE

MASTER'S PROGRAM IN APPLIED LINGUISTICS

THE DEVELOPMENT OF CORPUS-BASED GENRE-SPECIFIC WORD LIST AND THE SELF-STUDY MATERIALS FOR EAP TEACHING: THE CASE OF METALLURGICAL AND MATERIALS ENGINEERING

MASTER'S THESIS

Bera Taragay KARAOĞLU

ORCID:

Supervisor: Assoc. Prof. Dr. Ali Şükrü ÖZBAY

SEPTEMBER - 2025

TRABZON

APPROVAL

Upon the submission of the dissertation, **Bera Taragay KARAOĞLU** has defended the study "**The Development of Corpus-Based Genre-Specific Word List and the Self-Study Materials for EAP Teaching: The Case of Metallurgical and Materials Engineering"** in partial fulfillment of the requirements for the degree of Master of Arts in Applied Linguistics at Karadeniz Technical University, and the study has been found fully adequate in scope and quality as a thesis by **unanimous/ majority** vote on 30/10/2025.

Committee Member		Decision		Signature
Name and Surname	**Mission**	**Accept**	**Refuse**	
Assoc. Prof. Dr. Ali Şükrü ÖZBAY	Supervisor	☐	☐	
Prof. Dr. Ceyhun YÜKSELİR	Member	☐	☐	
Assist. Prof. Dr. Muhammed BAYDERE	Member	☐	☐	

Approval of the Graduate School of Social Sciences.

Prof. Dr. Haydar AKYAZI
Director

DECLARATION OF ORIGINALITY

I, **Bera Taragay KARAOĞLU**, hereby confirm and certify that;

- I am the sole author of this work and I have fully acknowledged and documented in my thesis all sources of ideas and words, including digital resources, which have been produced or published by another person or institution,
- this work contains no material that has been submitted or accepted for a degree or diploma in any other university or institution,
- all data and findings in the work have not been falsified or embellished,
- this is a true copy of the work approved by my advisor and thesis committee at Karadeniz Technical University, including final revisions required by them.
- I understand that my work may be electronically checked for plagiarism by the use of plagiarism detection software and stored on a third party's server for eventual future comparison,
- I take full responsibility in case of non-compliance with the above statements in respect of this work.

Signature………………..
Date 30.10.2025

ACKNOWLEDGEMENT

This thesis has been executed with considerable time and effort. I wish to extend my deepest appreciation to my supervisor, Assoc. Prof. Dr. Ali Şükrü Özbay, for his exceptional academic and motivational assistance throughout the extensive thesis phase. His mentorship and efforts, together with his encouraging demeanor towards his students, facilitated advancement through this path with optimism.

I express my profound gratitude to the jury committee members, Prof. Dr. Ceyhun YÜKSELİR and Assist. Prof. Dr. Muhammed BAYDERE, for their invaluable input and astute recommendations, which significantly aided in the completion of this thesis. In addition, I wish to express my heartfelt gratitude towards Prof. Dr. Ümit ALVER for his support and assistance.

I am sincerely appreciative of the altruistic endeavors of my beloved parents, uncle, aunt-in-law, and friends who endeavored to navigate this prolonged period alongside me with shared sentiments.

September, 2025 Bera Taragay KARAOĞLU

TABLE OF CONTENTS

CHAPTER FOUR

ÖZET

Akademik Amaçlı İngilizce (EAP) araştırmalarının önemli ve karmaşık bir yönü kelime öğretimidir. EAP kelime dağarcığının öğretimi ve edinimi, öğrencilerin ihtiyaçları, akademik bağlamda kullanılan kelimeler ve teknik terminoloji açısından geniş bir inceleme alanına sahiptir. EAP kelime dağarcığının bir alt boyutu olan Metalurji ve Malzeme Bilimi Mühendisliği İngilizcesi de bu kapsamda değerlendirilmekte olup, ilgili disiplinlerde eğitim gören ve çalışan bireyler için kritik bir öneme sahiptir. Bu bağlamda, bu tezin temel amacı, Metalurji ve Malzeme Bilimi Mühendisliği öğrencilerine yönelik alana özgü teknik kelime listeleri geliştirmek, Üretken Yapay Zekâ (GenAI) kullanarak sınıf içi etkinlikler tasarlamak ve bu etkinliklerin etkililiğini değerlendirmektir. Bu amaç doğrultusunda, SCI indeksli dergilerde yayımlanmış araştırma makalelerinden oluşan 1.788.459 kelimelik bir derlem (corpus) oluşturulmuştur. Derlem analiz edilerek Metalurji ve Malzeme Bilimi Mühendisliğinin dört alt alanına yönelik alana özgü teknik kelime listeleri geliştirilmiştir. En sık kullanılan kelimeleri belirlemek için derlem AntWordProfiler yazılımı ile analiz edilmiş ve ortaya çıkan kelimeler Akademik Kelime Listesi (AWL) ile Genel Hizmet Listesi (GSL1 ve GSL2) ile karşılaştırılmıştır. Karşılaştırma sonucunda en yaygın 800 terim seçilmiş, üç farklı teknik sözlükle birlikte GenAI “Gemini”ye yüklenmiş ve ilgili sözlüklerde yer alan kelimeler tespit edilmiştir. Araştırmacı tarafından yapılan manuel inceleme ve iki uzman doğrulaması sonucunda CMWL, MSWL, MWL ve PSTWL olmak üzere dört adet, her biri 200 kelimeden oluşan teknik kelime listesi oluşturulmuştur. Rastgele örnekleme yoluyla MWL sınıf içi etkinlik geliştirme süreci için seçilmiştir. MWL’den seçilen kelimelerle 9 katılımcıya ön test uygulanmış, ardından GenAI tarafından üretilen etkinlikler üç hafta boyunca uygulanmış ve son test gerçekleştirilmiştir. Bulgular, kelime öğreniminde %5,5 ile %20,5 arasında gelişim olduğunu ve son testin ortalama 10,44 puan daha yüksek olduğunu göstermektedir. Elde edilen sonuçlar, bu alanda türe özgü kelime öğretiminin gerekliliğini ortaya koymaktadır.

Anahtar Kelimeler: Teknik Kelime Bilgisi, Akademik Amaçlı İngilizce, Metalurji ve Malzeme Bilimi Mühendisliği İngilizcesi, Derlem Dilbilimi, Üretken Yapay Zeka

ABSTRACT

A significant and complex aspect of English for Academic Purposes (EAP) research is vocabulary instruction. The instruction and acquisition of EAP vocabulary, learners' needs, the lexical demands of academia, and the teaching of technical terminology have been the focus of extensive scholarly investigation. Metallurgical and Materials Science Engineering English, as a subfield-specific component of EAP vocabulary, is no exception and holds critical importance for students and professionals in the discipline. Therefore, the primary aim of this thesis is to develop discipline-specific technical word lists for students studying Metallurgical and Materials Science Engineering, to design classroom activities generated through Generative Artificial Intelligence (GenAI), and to evaluate the effectiveness of these GenAI-based instructional materials. To achieve this aim, a corpus of 1,788,459 words was compiled from research articles published in SCI-indexed journals, representing four subfields of Metallurgical and Materials Science Engineering. The corpus was analyzed to identify the most frequently occurring words, and AntWordProfiler software was employed to compare the corpus with three widely recognized word lists: the Academic Word List (AWL), the General Service List 1 (GSL1), and the General Service List 2 (GSL2). Following this comparison, the 800 most frequent terms were selected and uploaded to GenAI "Gemini" along with three technical dictionaries. GenAI was instructed to compare the word lists with the discipline-specific dictionaries in order to identify terms referenced in them. The researcher then manually reviewed the output and removed words that did not appear in at least one of the dictionaries. The refined lists were subsequently validated by two experts, resulting in four discipline-specific technical vocabulary lists of 200 words each, labeled CMWL, MSWL, MWL, and PSTWL. Random sampling was used to determine which list would form the basis of the classroom activities, and MWL was selected. A pre-test containing MWL items was administered to nine participants, followed by three weeks of GenAI-generated classroom instruction, after which the same test was administered as a post-test. Results showed improvements ranging from 5.5% to 20.5%, with the post-test scores averaging 10.44 points higher. These findings highlight the necessity for more genre-specific vocabulary instruction in this field.

Keywords: Technical Vocabulary, English for Academic Purposes, Metallurgical and Material Science Engineering English, Corpus Linguistics, Generative AI

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

AVL	: Academic Vocabulary List
AWL	: Academic Word List
CAWL	: Chemistry Academic Word List
CEC	: Cambridge English Corpus
CMWL	: Ceramic Materials Word List
COCA	: Corpus of Contemporary American English
EAP	: English for Academic Purposes
EAWL	: Environmental Academic Word List
ESP	: English for Specific Purposes
GenAI	: Generative Artificial Intelligence
GSL 1	: General Service List 1
GSL 2	: General Service List 2
MAWL	: Medical Academic Word List
MSWL	: Material Science Word List
MWL	: Metallurgy Word List
NAWL	: New Academic Word List
NAWL	: Nursing Academic Word List
NGSL	: New General Service List
PSTWL	: Polymer Science and Technology Word List
VMAWL	: Veterinary Medicine Academic Word List
VMC	: Veterinary Medicine Corpus

INTRODUCTION

Language functions as an identifier, a connection, and a communication tool in the world we live in. Among the variety of languages, the English language has long been the global lingua franca, facilitating interaction between people all over the world. As such, it is frequently taught as a foreign language. Learning vocabulary is a crucial component for foreign language learners due to its significant impact on language proficiency. Learners' comprehension of the course materials, academic performance, and reading comprehension are all strongly correlated with their vocabulary knowledge (Coxhead, 2020; Hu & Nation, 2000). As a result of the recognition of the critical nature of vocabulary and its influence on students, numerous academics (e.g., Browne et al., 2013a, 2013b; Coxhead, 2000; West, 1953) have devoted their time to vocabulary study in an effort to identify "essential" vocabulary, or "vocabulary that is frequently and widely used in English" (Miller, 2012). Creating word lists that could assist instructors as well as learners by emphasizing commonly or frequently utilized words is one outcome of these efforts. Naturally, the results of corpus-based research and the latest technological advancements have made it easier for researchers to reach this objective.

Since a corpus analysis tool is the way to analyze and sort the vast amounts of data stored, it is crucial to the development of word lists (Hunston, 2002). The number of corpus analysis programs grew along with the growing recognition of incorporating corpora in language instruction. WordSmith Tools, Sketch Engine, and AntConc are among the most widely utilized corpus analysis tools. Such programs enable the compilation, analysis, and sorting of vast corpus data to meet the researcher's needs in the creation of customized word lists. The freeware tool AntWordProfiler, created by Laurence Anthony (2024), provides an assortment of functions that researchers may utilize while analyzing compiled corpus data and creating word lists. It is a computer-based tool for analysis of corpus and vocabulary profiling. By processing different file types, statistics for a group of files or a color-coded representation of vocabulary levels for individual files can be created. Additionally, it is an ideal corpus tool for word list comparison. For this reason, it is a widely used corpus tool among researchers who want to create word lists (e.g., Özer & Akbaş, 2024).

West's (1953) General Service List (GSL), which contains the most frequently employed words in the English language, can be considered the forerunner of word lists. With a vocabulary set created primarily for academic purposes, Coxhead's (2000) Academic Word List (AWL) distinguished itself as one of the most prominent of these word lists after West's (1953) GSL. The New General Service List (NGSL) by Browne et al. (2013a), which is an updated version of the West's (1953) GSL, is another well-known word list. Although several researchers have recognized the educational value of these word lists, they have persisted in creating more discipline-specific word lists, such as those for medicine, engineering, agriculture, and, most recently, veterinary medicine, on the grounds that "lexical differences that exist across distinct disciplines may be greater than the similarities" (Martinez et al., 2009). Moreover, it would be worthwhile to investigate discipline-specific word lists in light of the importance and validity of specialized vocabulary, as well as the fact that students are required to develop specialized discourse abilities in order to succeed academically and contribute to group discussions (Hyland & Tse, 2007).

Thus, the primary objective of this corpus-based thesis is to develop word lists unique to Metallurgical and Materials Science Engineering by comparing words from other word lists and concentrating on discipline-specific publications published in SCI-indexed journals. Convenient sampling was utilized to choose the texts. The AntWordProfiler software was employed to analyze the selected texts, and the resulting word lists were compared to the GSL 1, GSL 2, and AWL in order to remove any similar vocabulary and extract discipline-specific word lists. Following this process, the GenAI "Gemini" was employed to create final word lists by uploading the compiled word lists along with three discipline-specific dictionaries. Then, in order to ascertain the words that were mentioned in the discipline-specific dictionaries, the researcher prompted GenAI "Gemini" to compare word lists with the discipline-specific dictionaries. After meticulously going over the generated word lists, the researcher removed words that were not included in the three discipline-specific dictionaries. The final phase was cross-checking the word lists produced by this analysis with two experts. For an examination of the correlation between the frequently utilized the NGSL (Browne et al., 2013a) and the New Academic Word List (NAWL) (Browne et al., 2013b) and the word lists derived from the Meta-MatCorp sub-corpora, AntWordProfiler was employed for comparison. In order to gauge the student's vocabulary skills and determine which words they knew and which they did not, the "Metallurgy" word list, which was chosen with a random sampling method, was utilized as a pre-test. Students were expected to translate the target words into Turkish (L1) for this test. Following the administration of the pre-test, for three weeks the students were given classroom activities (such as fill-in-the-blank, word matching, etc.) that were generated by GenAI "Gemini" based on the word list that was provided. The same vocabulary test was presented as a post-test three weeks after the pre-test was implemented, and the paired-samples t-test was utilized to examine the mean scores of the pre-test and post-test.

CHAPTER ONE

1. FRAMEWORK OF THE STUDY

1.1. Statement of the Problem

Due to its status as the lingua franca, English has started receiving greater prominence not only in the world of academia but also in corporate and educational spheres. As a result, this quick rise impacted the range of research conducted in the pertinent literature. Metallurgical and Materials Science Engineering is one of the fields that demands English-language communication, as it offers both academic and worldwide economic opportunities; thus, proficiency in the English language is essential for students pursuing this specific field. Therefore, English for Academic Purposes (EAP) is the best possible choice for students who wish to develop their English language and pursue academic careers in a specific field.

The importance of vocabulary in EAP stems from its significance in classroom practice and its representation of a particular group (Coxhead, 2016). Notwithstanding the lack of a consensus regarding the extent of specialized vocabulary (Coxhead, 2013), the quantity of such words can range from 1,000 to 5,000 words across several disciplines (Nation, 2008). Nonetheless, it has been demonstrated that selecting which words to teach and in what sequence can be problematic (Vongpumivitch et al., 2009). While there are various studies that concentrate on numerous fields such as business, veterinary medicine, and engineering (e.g., Li & Qian, 2010; Özer & Akbaş, 2024; Ward, 2009), there is a ubiquitous lack of investigation on the English language needs of students enrolled in the Metallurgical and Materials Science Engineering department. Therefore, exploratory research has been conducted to fill this gap in the literature. Developing discipline-specific technical word lists for four subfields of Metallurgical and Materials Science Engineering for EAP students interested in a career in this field, exploring the correlation between two widely utilized word lists and discipline-specific word lists driven from Meta-MatCorp sub-corpora, developing classroom activities employing generative AI, and assessing the effectiveness of the AI-generated instructional materials were the primary goals of this thesis.

1.2. Purpose of the Study

By comparing the frequency level of the words that are most prevalent in the corpora with GSL and AWL, the current thesis aims to ascertain high-frequency words that are exclusively utilized in the target corpus, thereby producing a discipline-specific word list for students studying Metallurgical and Materials Science Engineering.

The three primary objectives of this study are: a) building a database, Meta-MatCorp, by examining SCI articles from respectable journals, identifying the most frequently utilized and significant technical vocabulary in these articles based on expert opinions and discipline-specific dictionaries, and then compiling discipline-specific technical vocabulary lists based on these vocabulary items; b) to gain insight of how do the widely utilized word lists relate to word lists driven from Meta-MatCorp sub-corpora; c) creating instructional materials that students will benefit from in the classroom by combining GenAI with words from one of the discipline-specific technical vocabulary list; and d) assessing the efficacy of the instructional materials produced by Generative AI.

The following are the research questions that, in light of the primary objectives, direct the study:

1. Which discipline-specific technical words occur most frequently in the Meta-MatCorp corpus of Metallurgical and Materials Science Engineering?
2. How do the widely used word lists, the NGSL and the NAWL, relate to four discipline-specific technical word lists derived from corpora of scholarly articles published in SCI-indexed journals?
3. What is the impact of the instructional materials created by GenAI for students studying Metallurgical and Materials Science Engineering on their vocabulary scores?

1.3. Significance of the Study

As English has become increasingly prevalent worldwide, there is a greater requirement for students who wish to continue academic careers in their chosen fields to acquire discipline-specific terminology. The body of research on academic word lists has grown as a result. Numerous fields have been covered in these studies, including engineering, business, agriculture, and veterinary medicine. These word lists are essential for focused EAP learning because they let professionals and students interact with field-specific discourse and academic writing. Thus, EAP vocabulary unique to Metallurgical and Materials Science Engineering students is extremely valuable for those who hope to pursue a career in academia after graduation.

The review revealed that while academic word lists are available for numerous fields, the field of Metallurgical and Materials Science Engineering does not have one. As such, this study is significant considering that it concentrates on third-year Metallurgical and Materials Science Engineering students and attempts to create four technical word lists by analyzing Meta-MatCorp. These word lists, which include vocabulary curated for the academic requirements of students studying Metallurgical and Materials Science Engineering, significantly close a gap in the available resources. Such discipline-specific word lists are required to enhance specialized literacy in Metallurgical and Materials Science Engineering. Additionally, this research employs GenAI to generate classroom activities that encompass the most frequently used technical vocabulary and assess the effectiveness of the GenAI-generated instructional materials.

1.4. Limitations of the Study

Below is a list of the current thesis' limitations:

- There are five subfields within the area of Metallurgical and Materials Science Engineering, including “Composite Materials”, “Materials Science”, “Metallurgy”, “Polymer Science and Technology”, and “Ceramic Materials”. Due to an abundance of articles from other subfields, the thesis' corpus did not include any articles from the "Composite Materials" subfield. Therefore, discipline-specific technical word list that fall under the “Composite Materials” subfield might not be included in the word lists that were produced.
- According to their professor’s account, participants were taught to be at the A2-B1 level of English. As a result of the thesis, GenAI generated classroom exercises that are exclusively intended for students at the A2-B1 level of English. The results of the vocabulary translation test and classroom exercises can therefore only be interpreted for A2-B1 students.
- In the current thesis, production is not addressed in any way because the vocabulary test used as a pre-test and post-test throughout the data collection process and the classroom activities solely serve to improve receptive vocabulary knowledge.
- Since there was no delayed post-test given at the end of the data collection process, the thesis does not examine the participants' recall of the technical language that was the subject of the investigation.
- As the qualified participants for this thesis are 9, the vocabulary test analysis results may not be satisfactory.

CHAPTER TWO

2. LITERATURE REVIEW

2.1. Vocabulary in EAP

The instruction and study of English as a second or foreign language with the aim of enabling learners to utilize the language in a certain field is known as English for Specific Purposes (ESP). Under various labels, such as "technical, sub-technical, semi-technical, or specialized vocabulary," ESP has long focused its study on vocabulary instruction (Coxhead, 2013). In addition, Coxhead (2013) asserts that two fundamental characteristics render vocabulary crucial to ESP: a) identifying the specific requirements of teachers and students so that the learning environment can be structured appropriately, and b) such vocabulary offers disciplinary knowledge, thereby fostering a sense of belonging to a particular group of people. However, the focal point of this thesis is EAP, a subset of ESP with comparable values, rather than the ESP itself. In their study, Hyland & Hamp-Lyons (2002:2) state that "EAP has emerged out of the broader field of ESP, a theoretically and pedagogically eclectic parent, but one committed to tailoring instruction to specific rather than general purposes".

The phrase "English for Academic Purposes" depicts language learning and instruction that focus on the unique communication requirements and habits of different groups in academic settings (Charles, 2013). It implies establishing a foundation for teaching that is based on knowledge of the language, social, and cognitive requirements of specific academic fields (Hyland & Hamp-Lyons, 2002). It is crucial for EAP first- and second-language learners to acquire academic and disciplinary vocabulary. Learning to identify and employ language that is closely related to the subject of a particular field of study is the goal of this endeavor. In contrast to disciplinary vocabulary, which occurs only in a specific field, academic vocabulary is a subsection of vocabulary that occurs across various academic subject fields. For example, students would encounter this vocabulary in biology, chemistry, linguistics, or law. Discipline-specific vocabulary, on the other hand, can be encountered throughout literary works pertinent to specific fields of study but is seldom encountered outside of them. Another crucial component of the concept is the frequency of disciplinary lexical elements in texts. A greater rate of occurrence in a certain discipline might be interpreted as an indication of disciplinarity if the elements correspond with other study fields (Chung & Nation, 2004; Coxhead, 2016).

The research carried out by Akbarian (2010) evaluated the association between vocabulary depth and size among Iranian students learning ESP and EAP. Whether these two facets of vocabulary knowledge were separate or closely related—especially as language proficiency rises—was examined in this study. The study examined the correlation between vocabulary size and vocabulary depth by employing tests for both a mixed set of participants (112 Iranian graduate students in physics, mathematics, and e-commerce) as well as individuals separated into high and low proficiency levels. Size and depth have been identified to be strongly positively correlated, especially among higher-level students, suggesting that comparable causes frequently influenced both aspects of vocabulary knowledge. Consequently, Akbarian pointed out that there was more unexplained variance for learners with lower proficiency, indicating that these factors may be more pronounced during earlier phases of language learning.

Likewise, the investigation conducted by Khodabakhshi et al. (2014) assessed the vocabulary knowledge of Iranian undergraduate students enrolled in University of Kashan EAP courses. Their research sought to ascertain whether students in the engineering, scientific, and humanities faculties have the linguistic skills necessary to achieve success in the classroom. To evaluate students' comprehension of English words, Khodabakhshi et al. employed classroom observations and a receptive vocabulary test. Utilizing accepted definitions and other studies, they also analyzed the differences between several categories of vocabulary, including academic, technical, semi-technical, and ordinary English words. 135 students in total—48 from the engineering department, 25 from the sciences, and 43 from the humanities—participated. Due to their regular exposure to English in technical education, engineering students achieved the highest scores. Contrary to predictions, students in the humanities scored in the middle, while those in the sciences got the lowest. The results ultimately indicated that there were notable variations among the various disciplines of study and that the students' total vocabulary ability was lower than anticipated for EAP undergraduates. The Khodabakhshi et al. came to the conclusion that more pertinent and necessary terminology was required to be added to general English textbooks.

In a similar vein, Skoufaki and Petric (2021) conducted a study to examine the extent to which incidental learning of academic vocabulary was supported by in-house printed instructional materials utilized in a professional EAP course in the United Kingdom. They specifically investigated whether words from the Academic Vocabulary List (AVL), a list of 3,014 academic lemmas derived from the Corpus of Contemporary American English (COCA), were present and repeated. Compared to academic corpora like COCA, the study's findings indicated that 846 AVL lemmas (28.07% of the AVL) were included in the materials, accounting for 5.3% of all word tokens. While the greatest percentage of AVL coverage was found in vocabulary/grammar materials (25.83%), followed by speaking and listening (19.3%) and reading and writing (8.68%). Furthermore, their data demonstrated that approximately 13.59% of AVL lemmas occurred 10+ times, which was the threshold required for effective incidental learning. The majority happened less than 10 times.

Finally, they identified that while 85% of AVL-in-BAWE lemmas were included in the materials, only 25.62% of them were repeated ten or more times. Based on these results, Skoufaki and Petric deduced that in-house materials inherently contain a significant amount of high-frequency academic words, and EAP educators are advised to have training in frequency lists and corpus tools.

In another study, in a postgraduate course in China, Lu and Dang (2022) investigated the vocabulary requirements of EAP learning materials. They employed a triangulated approach, which incorporates interviews with six EAP teachers, vocabulary testing of 537 students, and corpus analysis of the course materials. Their objective was to ascertain how effectively the vocabulary in these instructional materials corresponds with students' real language skills as well as how instructors perceive and approach vocabulary training. A corpus of 88,622 words was developed utilizing a teacher-created handbook and a commercial textbook, and to find out how they felt about the terminology in the materials and the level of competency of their students, six instructors were interviewed. They discovered that the majority of students were only proficient in the 1000-word groups that were most frequently encountered. Over 20% of students had not even learned the first 1,000 words, and only 5.22% had enough vocabulary (4,000+ word families) to properly comprehend the materials. Students are required to memorize 4000-word families to achieve 95% comprehension. Furthermore, they deduced from the interviews that the majority of instructors thought the language was too complex for the students. In material design, vocabulary was frequently not given priority. Instead of adopting a principled approach to teaching vocabulary, teachers relied on their judgment or outside lists. These results demonstrate that vocabulary should be viewed as a primary learning goal rather than only a supplementary one. Additionally, instructors should exercise caution while choosing or modifying textbooks, making sure that they correspond with the real vocabulary levels of their students.

EAP's disciplinary vocabulary is frequently divided into four categories: “specialized, technical, semi-technical, and sub-technical” which is analogous to ESP vocabulary. Disparities in definitions of what constitutes discipline-specific language are sometimes indicated by these categories (Coxhead, 2013, 2016). “Sub-technical vocabulary,” for instance, is defined by Mudraya (2006) as lexical items in engineering that encompass both non-technical and technical senses. On the other hand, there have not been sufficient studies on technical vocabulary in texts, according to Chung and Nation's (2004) investigation of methodological techniques for identifying technical vocabulary. The source of this disparity, according to the authors, is due to the fact there was disagreement in the field on the precise meaning of this vocabulary along with how it might be accurately recorded. The necessity for additional study continues to exist, and numerous academics continue to examine different facets of technical vocabulary, despite the encouraging usefulness of empirical research on EAP vocabulary. Specialized word lists are one of these subject areas that has recently sparked interest; this will be addressed in more detail in the section that follows.

2.2. Corpus Based Studies on AWL

An essential aspect of ELT pedagogy and assessments is vocabulary instruction and learning. Conventional wisdom holds that word lists are beneficial in vocabulary acquisition. The GSL (West, 1953), which includes 2000 frequently employed English word families, and the 12 University Word List (Xue & Nation, 1984), which originated as an amalgamation of various preceding academic lists, are instances of rapidly expanding word lists. Among the developed word lists, the AWL (Coxhead, 2000) can act as a further illustration of this; in fact, it was the first to systematically establish a compilation of words based on a computerized academic corpus. West's GSL was revised by Browne et al. (2013a) to become the NGSL. Browne et al. (2013a) utilized a 273-million-word subset of the 2 billion-word Cambridge English Corpus (CEC) to develop the NGSL. In order to provide the maximum coverage with the fewest terms, they set out to compile a list of the most significant high-frequency words for second language learners. Furthermore, Browne et al. (2013b) developed the NAWL, which is a 957-word compilation of essential vocabulary for general academic English, intended to complement the NGSL, and serves as an updated substitute for Coxhead’s (2000) AWL. Later, as a seminal researcher in interdisciplinarity, Coxhead (2016) examined how word selection varies among fields. Her concept of discipline-specific vocabulary was that it refers to lexical words that are common in one discipline but less common in another. Corpus-based research has significantly improved our understanding of single-word and multi-word units, among other aspects of academic vocabulary (Coxhead et al., 2017). In recent years, corpus-based discipline-specific word lists have been established, such as those for applied linguistics (Vongpumivitch et al., 2009), engineering (Ward, 2009), medicine (Wang et al., 2008), and veterinary medicine (Özer & Akbaş, 2024).

In their study, Hyland and Tse (2007) assert that “a single inventory” cannot adequately reflect the lexicon of academic discourse, considering AWL items fluctuate greatly throughout different fields and a single word can exhibit noteworthy variances in collocational patterns, occurrence, range, favored meanings, and forms. They therefore advocate for the utilization of a more constrained, discipline-based lexical repertoire for English learners. Although technical and specialized academic word lists have been created independently, the technical vocabulary frequently utilized in the identical field needs to be taken into consideration when determining the length and specificity of an academic word list in a certain subject area.

There is one study that specializes in the word list particular to the medical field. The word frequency and text saturation of the 570-word families from Coxhead's AWL in medical research articles were studied by Chen and Ge (2007) utilizing a corpus of 50 research articles in English with 190,425 words. Approximately 10.07% of the text saturation in medical research articles has been made up of AWL words, 292 (51.2%) of the 570 AWL word families were identified to be regularly employed in medical research articles, and 10% of the text coverage was composed of academic words utilized in medical research articles. They came to the following conclusions based on these findings: (1) academic vocabulary constituted a substantial collection of lexical terms in medical research publications, with considerable textual saturation and dispersal; (2) the AWL underrepresents the academic words commonly employed in medical research articles; and (3) academic words have certain rhetorical purposes in academic texts. In Coxhead's corpus, they discovered that physician research articles used fewer high-frequency academic terms.

In order to assist medical English instructors in creating curricula, Wang et al. (2008) also created the Medical Academic Word List (MAWL), which lists the most commonly used medical academic vocabulary from a variety of medical sub-disciplines. 1,093,011 words of medical research articles from internet sources made up the corpus from which the MAWL was established. A total of 623-word families, or 12.24% of the tokens in the medical research articles, were included in the developed MAWL. According to Wang, instructors can define specific objectives for teaching vocabulary and concentrate on important medical academic terms with the aid of the MAWL. In addition to offering learners a more focused approach to acquiring medical academic vocabulary, the MAWL can assist students with studying EMP academic language in a more deliberate, explicit, and controllable manner. With more familiarity with medical texts, learners can solidify their MAWL vocabulary knowledge.

Creating the Nursing Academic Word List (NAWL) of the frequently utilized nursing academic vocabulary spanning multiple nursing branches was the primary objective of additional medical research conducted by Yang (2015). In order to identify the AWL and MAWL (Wang et al., 2008) word forms in the NAWL corpus and to determine the frequently occurring lexical items in all nursing sub-disciplines that are not among the first 2,000 English words provided in the GSL (West, 1953), he utilized the Nursing Research Articles Corpus (NRAC), a database of scholarly publications in the discipline of nursing that contains 1,006,934 words from approximately 252 research papers in the nursing field. Nursing students' cognitive proficiency of academic materials and skills in academic writing are intended to be enhanced by the 676-word NAWL, the sole collection of academic words unique to the field of nursing. Compared to the MAWL, the NAWL offers 3% additional coverage of nursing texts. According to Yang, the NAWL can be implemented as an outline for creating EAP materials and can assist EFL English students who want to pursue a career in nursing in expanding their vocabulary with greater efficiency.

Word lists were also developed for the professions of business. In their study of a Financial Services Corpus, Li and Qian (2010) sought to determine whether AWL elements were included in their corpus of financial papers as well as the most efficient way to impart them. The AWL had a 10.46% coverage in the corpus, according to Li and Qian (2010), while high-frequency AWL items were quite prevalent, with a cumulative coverage of 22.03%. Nonetheless, the wide range of the most common AWL items among the various text types amply demonstrated the peculiarity of the various text formats employed in the financial services field.

Ward's (2009) study emphasizes providing English instruction to engineering students who were required to utilize English-language materials for the duration of a portion of their course. Due to their secondary education, these students are frequently ill-prepared to study English-language engineering materials. The goal of Ward's word list was to provide general frequency and text coverage that would be beneficial to engineers in all sub-disciplines while still being sufficiently short and technical for students who are not proficient in the GSL or the AWL. The engineering corpus (EC), according to Ward, is genre specific (solely textbooks), balanced (providing equal prominence to each field), a good representation (which corresponds to a broad spectrum of areas in chemical, civil, electrical, industrial, and mechanical engineering fields), and pertinent to students' needs (educational materials for the subsequent years of undergraduate study), whereas other more extensive corpora fail to meet the unique requirements of students. Of its 271,000 tokens, EC has 10,290 different word kinds. Students have no trouble tackling the 299-word, non-technical Basic Engineering List (BEL), which is intended for engineering students. In addition to encouraging acquisition of distinct words, it also provides adequate representation of a broad spectrum of engineering textbook material by focusing on word types in lieu of lemmas or families.

In an EFL setting, a word list was developed by Valipouri and Nassaji (2013) for graduate-level learners studying chemistry by examining a 4-million-word corpus of academic papers in the discipline to determine commonly utilized vocabulary. A corpus of 4 million words has been developed from 1185 chemical research article publications in the fields of analytical, organic, inorganic, and physical/theoretical chemistry. In the chemical corpus, they discovered that 1400 word families are commonly utilized. These terms fall under the heading of Chemistry Academic Word List (CAWL). It is evident that academic words are not utilized consistently throughout fields since several of the AWL words were not utilized as often in chemistry as the CAWL words were, and the high-frequency AWL words had an entirely distinct frequency pattern from those in Coxhead's AWL. The CAWL corpus additionally contained a substantial amount of non-AWL content word families, which further reinforces the notion that discipline-specific vocabulary lists based on the intended academic texts must be created (Hyland & Tse, 2007; Martinez et al., 2009; Wang et al., 2008).

The saturation, frequency, distribution, and meaning of the terms from the AWL in agricultural research publications are the primary themes of Martinez et al.'s (2009) study that analyzed an 826,416-word corpus. According to their findings, the corpus's list of frequently occurring words from the AWL was more condensed than those of Hyland and Tse (2007) and Chen and Ge (2007), which could potentially help meet the unique demands of agriculture ESP learners. As a very constrained vocabulary list from the AWL, the results offer targeted, detailed information on several facets of the academic language of agriculture research articles. This condensed collection of often occurring AWL families supports the idea put out by Hyland and Tse that frequency lists must be constructed straight from the target texts. The goal of providing learners with a list of words they are likely to encounter frequently is better served by such targeted lists (Nation & Waring, 1997).

The Applied Linguistics Research Articles Corpus (ALC), which consists of 200 research articles that were published in five international journals, has been utilized by Vongpumivitch et al. (2009) as part of their corpus-based lexical study to investigate the incorporation of words in Coxhead's (2000) AWL in applied linguistics journal articles. 128 non-AWL content word forms and 475 AWL word forms that are commonly utilized in applied linguistics were compiled in this study. According to Chen and Ge's (2007) findings, the AWL's coverage in applied linguistics (11.17%) is greater than that of the art field (9.3%), which was examined by Coxhead (2000), and medical research (10.07%). Consequently, similar to other hitherto studied fields, the AWL terms were determined to be crucial in the field of applied linguistics.

To assist students in acquiring an excellent grasp of specialized English, Liu and Han (2015) developed a preliminary environmental academic word list (EAWL) in the field of environmental sciences. Upon examining the AWL saturation of the corpus of environmental science, they discovered that, due to variations in the quantity of technical terms employed in each topic area, the AWL fluctuates within the environmental science discipline. There is a substantial amount of technical medical terminology within these texts, as evidenced by the fact that the AWL word coverage fluctuates throughout different types of research essays (Li & Qian, 2010) and only encompasses 6.72% of the corpus of medical texts (Cobb & Horst, 2004). The concepts are represented differently in distinct fields since the natural sciences are more likely to emphasize the depiction of findings, while the social sciences are more likely to concentrate on expressing concepts. Instead of describing phenomena, the AWL terms are typically employed to convey opinions (Coxhead & Nation, 2001). According to Chen and Ge (2007) and Martinez et al. (2009), research articles' discussion sections tend to have more AWL word families, whereas their result sections typically have fewer AWL word families.

Most recently, Özer and Akbaş (2024) developed the first veterinary medicine academic word list (VMAWL) from the Veterinary Medicine Corpus (VMC) in order to address the needs of veterinary medicine students and to promote field-specific academic literacy. The positive aspects of discipline-specific word lists have been demonstrated by prior research in comparable professions such as nursing and medicine. A collection of research articles published between 2010 and 2022 constituted the Veterinary Medicine Corpus (VMC), which was assembled by the authors. To determine the most frequent and widely distributed content words, they employed the LancsBox 6.0 program to analyze the corpus. The crucial vocabulary for academic prose in veterinary medicine is represented by the 835 part-of-speech-tagged lemmas (P-lemmas) in the final Veterinary Medicine Academic Word List (VMAWL). It was discovered that the VMAWL covered 13.75% of the VMC better than typical academic word lists like the AWL and the NGSL. According to the authors, learners' academic literacy in VM can be greatly enhanced by integrating the VMAWL into instructional materials. The list's high degree of lexical coverage was further confirmed by validation against the VMC. Additionally, the study provides details on the methods employed to guarantee the validity and reliability of the VMAWL as well as the selection of lexical units (such as word families, lemmas, and P-lemmas). In order to develop an accurate and beneficial word list for educational purposes, the authors stress the significance of utilizing corpus evidence.

As demonstrated by the examples (e.g., Liu & Han, 2015; Özer & Akbaş, 2024; Wang et al., 2008) in this section, field-specific academic word lists are essential to enhancing comprehension, communication, and success in specialized fields and can help students study more efficiently than general academic word lists. By bridging the gap between the specialized requirements of many fields and general academic vocabulary, they improve the effectiveness and focus of learning.

Table 1: Corpus-Based Studies on Word Lists

Author	Year	Aim	Focus	Corpus Text	Corpus Size
Mudraya	2006	Frequency-based student engineering vocabulary corpus	Field-Specific Vocabulary	English language textbooks in engineering departments	1,986,595 words
Chen & Ge	2007	Medical Research Articles' AWL word family distribution	Academic Vocabulary	Medical Research Articles	1.093.011 words
Hyland & Tse	2007	Distribution of AWL throughout several academic fields	Academic Vocabulary	Research Articles, textbooks, book review, scientific letter, MA, PhD and Final year thesis	3,3 million words
Wang et al.	2008	A medical academic word list	Academic Vocabulary	Medical Research Articles	1,093,011 words
Ward	2009	An elementary list of words in engineering English	Discipline-Specific Vocabulary	Engineering textbooks	271,000 words
Vongpumivitch et al.	2009	Applied Linguistics Research Articles' AWL and Non- AWL content words	Academic Vocabulary	Applied Linguistics Research Articles	1.5 million-words
Martinez et al.	2009	Academic Terminology for Research Articles in Agriculture	Academic Vocabulary	Agriculture Research Articles	826,416 words
Valipouri & Nassaji	2013	Chemistry Research Articles' academic vocabulary	Academic Vocabulary	Chemistry Research Articles	4 million words
Li & Qian	2015	Academic words in the corpus of financial services	Academic Vocabulary	Annual reports, brochure, fund description, ordinances, speeches	6,3 million words

Table 1: (Continued)

Yang	2015	Word list for the nursing field	Academic Vocabulary	Nursing Research Articles	1,006,934 words
Liu & Han	2015	A list of words relevant to a field and evaluating its legitimacy	Academic Vocabulary	Environmental Science Research Articles	862,242 words
Özer & Akbaş	2024	Veterinary medicine academic word list	Academic Vocabulary	Veterinary Research Articles	8,000,000 words

Reference: Coxhead, 2011: 356

2.3. What is Technical Vocabulary?

It has been frequently acknowledged that technical vocabulary is crucial for understanding specialized texts and serves a key role in the instruction and comprehension of disciplinary-specific English in EAP courses (e.g., Chung & Nation, 2003; Kwary, 2011; Woodward-Kron, 2008). Although it is necessary to define technical vocabulary for the aim of this thesis, the first thing that must be discussed is the vocabulary classifications. Prior studies have classified vocabulary into four distinct classifications: low-frequency vocabulary, academic vocabulary, technical vocabulary, and high-frequency words. Low-frequency words are those that are not high-frequency, academic, or technical for a given subject; high-frequency words are those that comprise a significant portion of the vocabulary in spoken and written texts; academic words are those that are frequently employed in various types of academic texts; and technical words are those that are extensively associated with the text's subject area (Chung & Nation, 2003; Liu & Lei, 2020; Nation, 2013). Chung and Nation (2003) state that although there is a wealth of study on the nature and coverage of academic and high-frequency terms, technical vocabulary and low-frequency words have received less attention. A detailed review of the literature on the subject shows that there has not been any agreement on how to define and categorize technical vocabulary (Chung & Nation, 2003; Liu & Lei, 2020). In a similar vein, due in large part to the lack of recognized methods for classifying words as technical or non-technical and the ubiquitous lack of studies comparing the efficacy of various methods, Chung and Nation (2004) claim that relatively little is known about technical vocabulary. Nevertheless, Nation (2013) offers a fresh classification for vocabulary in his book, despite the fact that the challenge still exists. He mentions “specialized vocabulary” as a separate classification in addition to the frequency-based word classifications. He differentiates between two sub-levels of specialized vocabulary—academic vocabulary and technical vocabulary—and describes the characteristics of these concepts.

Table 2: Vocabulary Types

Word Level	Characteristics
Academic	• Various studies have given it different titles, such as "semi- technical", "sub-technical", or "academic vocabulary". • The AWL, created by Coxhead (2000), is the most well-known. • Academic terms from four distinct topic areas—law, science, the humanities, and commerce—can be found among the 570 word families in AWL. • When high-frequency vocabulary becomes prevalent in academic texts, their coverage rises to 86.1%. • About 8.5% of academic texts, 4% of periodicals, and less than 2% of novel running words are covered by AWL. • Despite being used in many fields of study, academic vocabulary is not always considered high-frequency and is not considered technical because it is not specific to a single field.
Technical	• Technical terms are intimately associated with specific fields of study. • They may originate from various word levels, including high, mid, and low frequency. • The subject-specific nature of technical vocabulary causes it to differ greatly between fields of study. • Professional language contains an extensive number of technical terms.

Reference: Liu & Lei, 2020; Nation, 2013.

Taking into account both of the aforementioned categories, the technical vocabulary category has been examined for the goals of this study. Nation (2013) asserts that technical vocabulary may originate from any of the three tiers of vocabulary, and certain high-frequency words could correspond to technical terms utilized in specific fields. In specific disciplines, certain academic expressions that are mid-frequency may acquire technical connotations, and phrases that are low-frequency in a particular discipline might be technical in a different one. Additionally, he provides an example that clarifies this circumstance: "For example, arm, leg and neck are technical words in the field of anatomy. Language, word, and comprehend are technical words in applied linguistics" (Nation, 2013:304).

Thus, the target vocabulary in the thesis is characterized as words that are not included in the first 800 words in both GSL and AWL. After computer-based analysis, all high-frequency words were cross-checked with two experts—one of whom is a professor in the field of Metallurgical and Materials Science Engineering, and the other is a professional in teaching technical vocabulary—in order to distinguish between technical vocabulary and low-frequency words. In addition, according to Nation (2003), a family of terms (such as "apply" and "applied") is not always technical merely because one or two of its members are. Therefore, word types are employed as the unit of counting among the 1,788,459 words for analysis purposes rather than word families.

2.4. Utilization of Generative AI in Higher Education

The educational landscape is shifting due to the swift advancement and widespread application of generative artificial intelligence (GenAI) technologies, which provide cutting-edge resources that could improve both students' learning outcomes and teachers' pedagogical approaches (Ulla et al., 2024). Several research studies in the field of language education have recognized the potential of GenAI for generating interactive classroom language activities and language courses that assist both students' learning outcomes and teachers' pedagogical approaches (e.g., Cotton et al., 2024; Konke et al., 2023). However, there are also reservations regarding the technology's effects on education and learning given its exponential growth, broad accessibility, and utilization as a tool (Darvishi et al., 2024). The advantages, disadvantages, challenges, and solutions of incorporating GenAI tools into education have been outlined in a number of studies (e.g., Cotton et al., 2024; Kohnke et al., 2023; van Niekerk et al., 2025; Wang et al., 2024).

A study by Kohnke et al. (2023) examines the possible benefits and drawbacks of ChatGPT in language instruction. They claim that ChatGPT offers a number of pedagogical benefits, including: (1) enhances language learning through the generation of texts in a variety of genres, correcting grammatical errors, simulating real-world interactions, and offering dictionary definitions and translations; (2) provides real-time language practice and assistance, allowing students to practice their skills at any time and from any location; (3) has the ability to modify the proficiency level, provide individualized learning materials, and recommend tailored courses of study based on the needs of learners; and (4) is able to conduct formative assessments and provide immediate feedback, which is essential for language acquisition. Kohnke et al. likewise addressed the arguments and drawbacks surrounding the utilization of ChatGPT in the field of education: (1) worries about cheating and its implications on assessments and originality; (2) the possibility of inaccurate responses resulting in misinformation; and (3) the likelihood that responses reflect cultural biases from the training corpus, which is primarily in English.

In a similar vein, Cotton et al. (2024) inquired about the possible drawbacks as well as benefits of AI tools when analyzing the advantages and disadvantages of utilizing ChatGPT (one of the GenAI tools) in higher education. They additionally addressed the challenges of identifying and preventing plagiarism in academia and provided a number of strategies that colleges might implement to guarantee ethical and appropriate utilization of these resources. One benefit of GenAI platforms such as ChatGPT, according to Cotton et al., is that they have the capacity to support asynchronous conversation, which boosts student participation and teamwork. Higher education cannot function without assessment, which allows educators to gauge students' learning and development. In order to provide a more effective and customized educational experience, they also noted that ChatGPT can be utilized for interactive game-based assessments, personalized assessments, and assignment grading. On the other hand, Cotton et al. identified two significant issues associated with employing

ChatGPT for assessments in higher research: (1) the possibility of academic dishonesty and plagiarism, as AI could be abused by students to generate essays and other projects, and (2) the possibility of inconsistent assessment procedures due to the unfair advantages that students with access to ChatGPT might have over those without. They proposed an assortment of strategies to prevent such circumstances, including utilizing language analysis tools, scanning for patterns, reviewing sources and citations, ensuring originality, and checking for factual inaccuracies. Additionally, designing activities that call for creativity, originality, and critical thinking will further complicate it for students to utilize AI.

Wang et al. (2024) carried out a retrospective analysis in their study by utilizing ChatGPT to provide criticism regarding 50 sets of argumentation topics that instructors had previously reviewed in order to investigate the possibility rate of reliability and credibility associated with utilizing ChatGPT for argumentation feedback. Wang et al. claimed that ChatGPT was able to provide feedback on arguments with a precision percentage of 91.8% and a recall percentage of 63.2%; however, it was discovered that the overall length of the arguments and the existence of discourse markers had a significant effect on ChatGPT's reliability. In contrast to ChatGPT, which offers instantaneous, comprehensive, text-based feedback on a wide range of argumentation, instructor feedback concentrated on students' overall learning progress, drew from the author's own teaching experience, and incorporated human empathy. Despite ChatGPT's capacity to offer insightful feedback on students' arguments, they ultimately came to the conclusion that it is most effective when combined with instructor feedback.

In a different study, van Niekerk et al. (2025) investigated how students' academic writing and learning processes were affected by generative AI tools like ChatGPT. They measured students' opinions of ChatGPT's utility and usability in academic writing through the Technology Acceptance Model, an approach that is frequently employed to evaluate the desire to adopt a new technology. In order to raise awareness about the limitations of AI-generated texts, they encouraged students to utilize ChatGPT to write essays, assess them critically, and reflect on their experiences. Although ChatGPT generated well-written content, the results demonstrated that it lacked essential insights and frequently created unreliable references. The perspectives of students were successfully influenced by the intervention, which exposed them to common problems with AI-generated text, especially ChatGPT's tendency to generate inadequate references and "hallucinate" information. As a result, students became less reliant on ChatGPT for academic writing and became increasingly skeptical about AI-generated texts.

By submitting the technical word lists created from the Meta-MatCorp utilizing AntWordProfiler to GenAI "Gemini", this study seeks to develop study materials for university students while keeping in mind the benefits and drawbacks of GenAI as previously discussed.

CHAPTER THREE

3. METHODOLOGY

3.1. Data Collection Instruments

3.1.1. Research Data

The data used in this thesis comes from a corpus called "Meta-MatCorp" which was developed by the researcher, and it comprises four sub-corpora that consist of the sub-disciplines of Metallurgical and Materials Engineering, "Ceramic Materials", "Materials Science", "Metallurgy", and "Polymer Science and Technology". A total number of 400 research articles published in respectable journals with an SCI index made up the "Meta-MatCorp", and each sub-corpus of "Meta-MatCorp" consists of 100 research articles. Furthermore, the research articles are available to the public or through institutions, which makes them appropriate study resources for convenient sampling.

Table 3: Meta-MatCorp Index

Meta-MatCorp				
Sub-Corpora	**Corpus Text**	**Article Quantity**	**Focus**	**Number of Words**
Ceramic Materials	RA	100	Discipline Specific Vocabulary	387,595
Materials Science	RA	100	Discipline Specific Vocabulary	482,476
Metallurgy	RA	100	Discipline Specific Vocabulary	451,564
Polymer Science and Technology	RA	100	Discipline Specific Vocabulary	466,824
Total		400		1,788,459

Following the procedures of earlier studies on word list creation (e.g., Chung & Nation, 2003; Li & Qian, 2015; Liu & Hun, 2015; Martinez et al., 2009; Wang, 2008), all images and tables were eliminated from the content section once the target texts had been identified. The remaining text, which made up the study database to be run via the corpus analysis program AntWordProfiler, had a total of 1,788,459 words, of which 387,595 (Ceramic Materials), 482,476 (Material Science), 451,564 (Metallurgy), and 466,824 (Polymer Science and Technology) words. The researcher initially trimmed the lists to a lesser length, selecting the top 800 words for each word list. Three discipline-specific dictionaries and each word list were uploaded to the GenAI "Gemini" in order to generate final word lists. The researcher prompted GenAI "Gemini" to compare word lists with the discipline-specific dictionaries to detect the words that were listed in the discipline-specific dictionaries. Throughout this process, the researcher discovered that GenAI "Gemini" did not consistently yield reliable outcomes, since it presented words absent from the three specialized dictionaries and referenced dictionaries not related to the field. In order to verify the reliability and credibility of the lists produced by GenAI "Gemini", three validation methods were implemented. Firstly, the researcher initially repeated the same prompt and input data to ascertain whether the output data were identical or nearly identical. This validation method's results indicated that the output data were nearly identical. Secondly, a manual examination of the word lists produced by GenAI "Gemini" by the researcher was necessary to validate the reliability and credibility of these lists. The researcher eliminated words that were not present in the three discipline-specific dictionaries—the ASM Materials Engineering Dictionary by Joseph R. Davis (1992), the Dictionary of Metallurgy by Colin D. Brown (1998), and MetalBilim ve GerecBilim by Erdoğan Tekin (2006)—during the manual review of the word lists generated by GenAI "Gemini". Lastly, the reliability and credibility of the word lists compiled throughout this procedure were further verified through a cross-check with two experts, who were relied upon to provide their evaluation.

3.1.2. Setting and Participants

The current study was conducted at Karadeniz Technical University's Department of Metallurgical and Materials Engineering. A total of 37 third-year engineering students participated in the study. Since 28 of the participants just took part in the class activities and did not take the pre-test or post-test, they were not included in the analysis. According to Jackson (2011:320) and Scott and Usher (2011:61–70), there are six distinct models of quasi-experimental research: Single-Group Post-test Only Design, Single-Group Pre-test/Post-test Design, Single-Group Time-Series Design, Nonequivalent Control Group Post-test Design, Nonequivalent Control Group Pre-test/Post-test Design, and Multiple Group Pre-test/Post-test Design. The second type of quasi-experimental design, known as "Single-Group Pre-test/Post-test Design" was employed in this thesis. In a single group, the third-year students in the Metallurgical and Materials Science Engineering Department took a vocabulary test at the start and end of their treatment.

3.1.3. Pre-Test/Post-Test Procedure

In total, the researcher created 4 word lists, one for each sub-corpus of Meta-MatCorp. Following the development of the word lists, consultations were held with a professional and a technician in the field. They were granted access to the lists and provided their approval regarding the significance and commonality of the words within the field. There were 800 words total, with 200 words in each word list's final form.

The random sampling method was employed to determine which of the word lists would be used to create the vocabulary test. As a result, the 200 words from the “Metallurgy” word list were utilized in the vocabulary test. Participants were required to translate the target technical word into their native language as part of a simple translation test. This test was conducted with two specific objectives in mind: first, to determine which words the participants knew, and second, to assess their vocabulary retention following GenAI-generated classroom activities. A sample from the vocabulary translation test administered at the initial phase of the study is included in Table 4 below. Post-testing was conducted using the same vocabulary exam to see whether the participants' vocabulary had improved as a result of the GenAI-generated classroom activities.

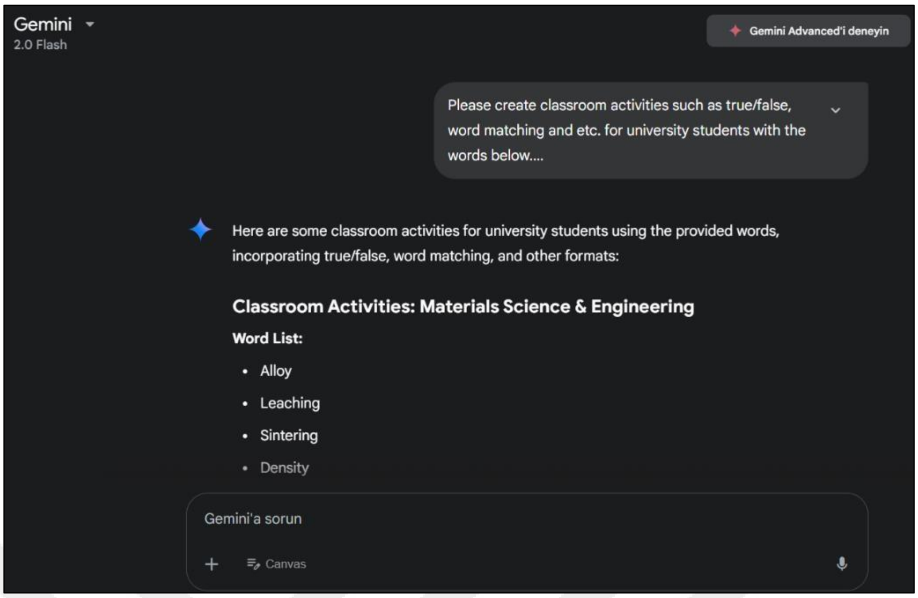
Table 4: An Example From Vocabulary Test

Please write the Turkish meanings of the vocabulary items given in English below. (Please leave the meanings for the vocabulary items you do not know empty). Lütfen aşağıda İngilizcesi verilen kelimelerin Türkçe karşılıklarını yanlarına yazınız. Bilmediğiniz kelimeleri boş bırakınız	
Alloy =	Oxide =
Leaching =	Hydrogen =
Flakes =	Diffusion =
Density =	Pore/Porosity =
Matrix =	Electron =
Carbon =	Magnetic =
Microstructure =	Lamellae=
Composite (material) =	Vacuum =
Acid =	Coke =
Deformation =	Feed =

3.1.4. Classroom Activities

The 200-word "Metallurgy" word list and the GenAI tool "Gemini" were utilized to generate the classroom exercises. The artificial intelligence system GenAI “Gemini” was created by Google AI. With its multimodal design, it is Google's most sophisticated and powerful AI model. In contrast to AI models that generally process text, GenAI “Gemini” is designed to comprehend and reason with a variety of data kinds, such as code, text, images, audio, and video. This multimodality, which reflects how individuals perceive and interpret the world through a variety of senses, enables GenAI “Gemini” to manage more complex and diverse tasks. In this thesis, the researcher utilized GenAI “Gemini” to generate classroom activities from the 200-word "Metallurgy" word list. In Figure 1, an example page is displayed below.

Figure 1: How to Create Classroom Activities With Gemini



The researcher created five distinct kinds of classroom exercises for this study utilizing GenAI "Gemini": multiple choice, fill in the gaps, match the words, true or false, and translation. Participants are expected to complete these GenAI-generated classroom activities by selecting the appropriate word from the word bank, matching the word to its definition, determining whether each statement is true or false, selecting the right option, and translating the sentences into their native language. Appendix 6-10 shows examples of each GenAI-generated classroom activity.

Context-based fill-in-the-blanks activities were the first type of GenAI-generated activities; these types of activities offered students an opportunity to observe how the words might be used in an authentic context. As illustrated in Appendix 6, the participants were instructed to read the statement and then locate the word that completed it. In addition to teaching students the target words, these types of activities demonstrate how to apply them in context.

The second type of GenAI-generated activities, as illustrated in Appendix 7, were match-the-word tasks, where students had to match words to their definitions. These kinds of exercises provide an engaging and successful way to assist students in advancing their discipline-specific vocabulary. While the third type of GenAI-generated activities were truth or false activities where participants were instructed to determine whether the statements were true or false, as seen in Appendix 8. When utilized carefully, these kinds of activities can improve engagement, critical thinking, and comprehension.

The fourth type of GenAI-generated activities, as shown in Appendix 9, were multiple-choice activities in which participants were tasked to choose the right option. Through the reduction of pressure, emphasis on recognition, and confidence-building, these kinds of activities can be an effective tool for assisting students in learning discipline-specific technical words. Appendix 10 illustrates the final type of GenAI-generated classroom activities, which involved instructing students to translate texts into their native language. By encouraging deeper comprehension, enhancing language awareness, and assisting students in acquiring a variety of critical abilities, these kinds of activities can be an invaluable asset in learning discipline-specific technical vocabulary when utilized carefully and moderately.

3.2. Data Collection Procedure

This thesis employed a three-week data collection period to investigate the impact of GenAI-generated classroom activities on the instruction of discipline-specific technical terminology. Participants engaged in classroom sessions administered weekly on Tuesdays, each lasting approximately 45 minutes. A vocabulary pre-test was conducted during the initial week of data collection. Recognizing that the allotted classroom time was insufficient for complete activity engagement, participants were instructed to continue their learning independently throughout the remainder of each week. To evaluate the efficacy of the classroom activities in facilitating discipline-specific technical vocabulary learning, a post-test was implemented in the final week of the data collection phase.

3.3. Data Analysis

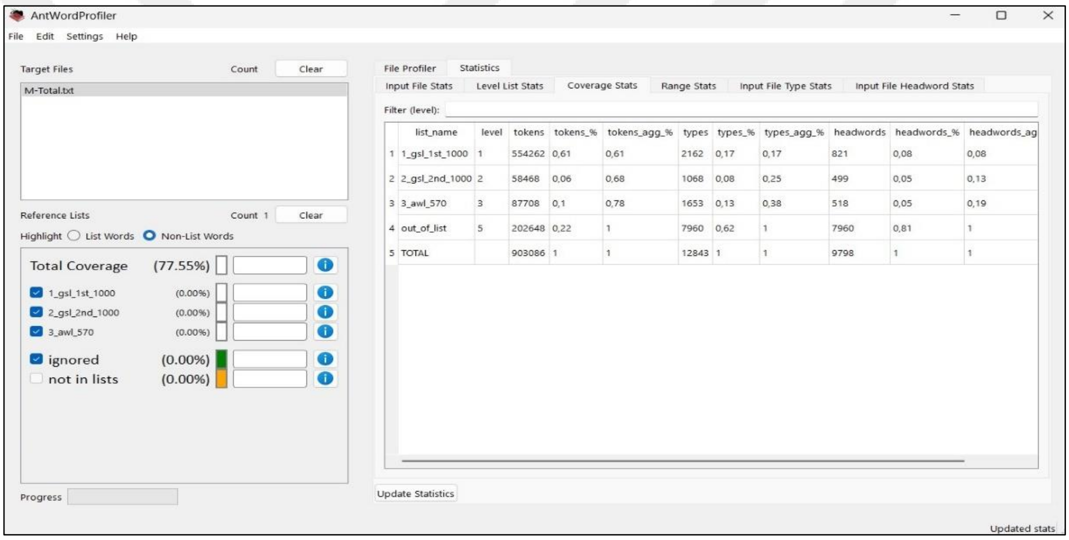
3.3.1. Corpus

The most crucial question for the examination of the target study database is how to differentiate the technical vocabulary from other words. Chung and Nation (2004) presented four ways for identifying technical terminology in a text: computer-based approach, technical dictionary, rating scale, and textual cues. In order to determine which of these approaches produces the most dependable and effective outcomes, Chung and Nation (2004) compare all of them in their study. This study indicates that the rating scale approach is the most accurate method since it perfectly overlaps with the terminology included in Dorland's dictionary, which includes technical terms related to anatomy, and it has a 100% rate of every measurement they employed. In comparison to the rating scale method, the computer-based approach is less accurate. It provides a rough estimate of technical terms, but it is not comprehensive enough because it also identifies collocates and finds it challenging to pinpoint terms that are also frequently employed outside of the field of specialization. On average, nevertheless, this method's satisfaction rate was 82.7%. Additionally, it is more time-efficient than the rating scale approach.

According to Chung and Nation (2004), “In terms of practicality, the computer-based approach works very well and if common collocates are included as well as terms, it is quite successful”. So, for the purposes of this thesis, a computer-based approach was preferred because it is efficient in terms of time as well as precision. AntWordProfiler, created by Laurence Anthony (2024), is the corpus analysis tool utilized in this study. The RANGE software, created by Heatley et al. (2004), has been employed in the majority of the prior studies that concentrate on word list creation (Li & Qian, 2010; Liu & Hun, 2015; Yang, 2015). Nevertheless, Heatley et al. claims that “AntWordProfiler is a more modern vocabulary analysis program, with numerous extra features”.

3.3.2. AntWordProfiler

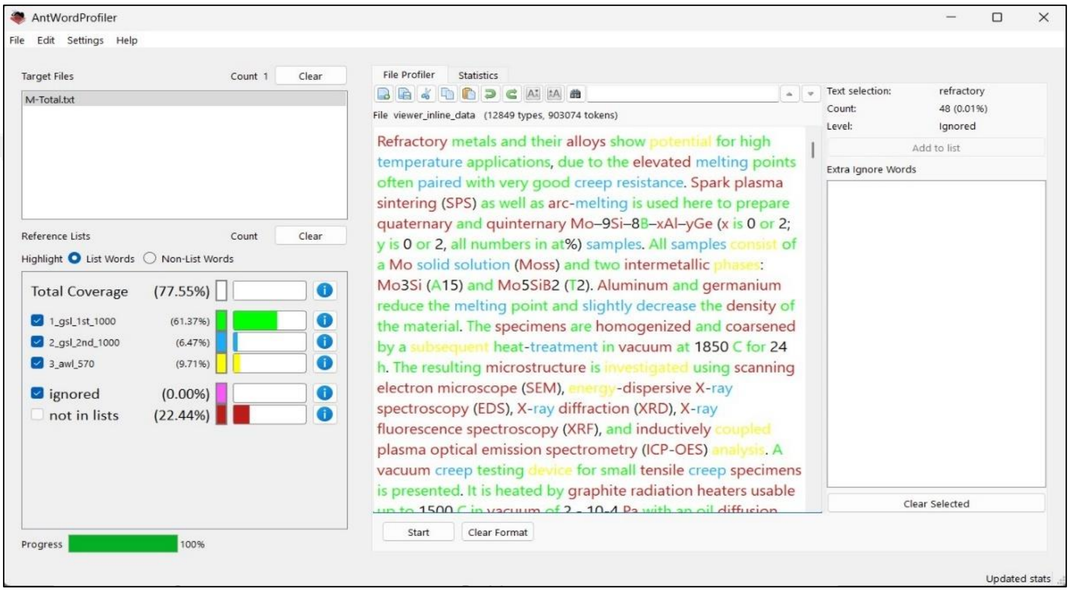
Figure 2: Vocabulary Profile Tool Main Frame



AntWordProfiler is a computer-based tool for vocabulary profiling that analyzes corpora. A color-coded display of the vocabulary levels for individual files or statistics for a collection of files can be produced by processing Microsoft Word (.docx), PDF (.pdf), and TEXT (.txt) (UTF-8 encoded) files. Two distinct tools are included in this program: the “File Viewer and Editor Tool” and the “Vocabulary Profile Tool”. Three pre-existing vocabulary level lists can be compared to a target text using the program's primary vocabulary profile feature. The pre-existing lists are 1000 words in GSL, 2000 words in GSL, and AWL. This tool allows individuals to compare lists based on the tokens they contain, shows statistics showing the percentage of target text that contains GSL 1, GSL 2, or AWL words, and generates word lists by both adding and removing words from pre-existing lists, as shown in the picture below. For conducting corpus linguistics research, this software is incredibly quick and easy to use. Figure 2 illustrates the Vocabulary Profile Tool Main Frame.

The software’s second built-in tool is a file reader and editor that lets individuals see a single file while utilizing a color-coding system to highlight words in various vocabulary level lists. The percentages on the right, which show how many words from the provided vocabulary level lists make up the corpus, are indicative of the analysis of the screenshot in Figure 2. As illustrated in Figure 3 below, GSL 1, GSL 2, and AWL comprise 77.55% of the Metallurgy sub-corpus, with percentages of 61.37%, 6.47%, and 9.71%. The colors green, blue, and yellow stand for the GSL 1, GSL 2, and AWL vocabulary level lists, respectively, while red represents all other words that are not listed in any of these lists. This application allows the individuals to view all the words in or out of the original text's vocabulary level lists in a color-coded fashion.

Figure 3: File Viewer and Editor Tool Main Frame



3.3.3. Test Analysis

The data from the pre-test and post-test were analyzed using the Statistical Package for Social Sciences (SPSS). A paired-samples t-test was used to compare the pre-test and post-test mean scores in order to examine any differences.

CHAPTER FOUR

4. RESULTS

4.1. Word Lists

Creating a data-based technical term list based on frequency and expert opinion is the primary objective of the first research question. A total of 1,788,459 words composes the database created for the study, with the following breakdown of word distributions: 387,595 (Ceramic Materials), 482,476 (Material Science), 451,564 (Metallurgy), and 466,824 (Polymer Science and Technology).

Table 5: AntWordProfiler Results

		Ceramic Materials			Material Science			Metallurgy			Polymer Science and Technology		
Level	File	Token	Token%	Coverage%	Token	Token%	Coverage%	Token	Token%	Coverage%	Token	Token%	Coverage%
1	GSL 1st 1000	241,983	0,62	62,43	296,496	0,61	61,45	277,131	0,61	61,39	280,200	0,6	60,02
2	GSL 2nd 1000	26,449	0,07	6,82	32,101	0,07	6,65	29,234	0,06	6,47	34,300	0,07	7,35
3	AWL 570	36,686	0,09	9,47	48,432	0,1	10,04	43,854	0,1	9,70	49,065	0,11	10,51
5	Not in the lists	82,477	0,21	21,28	105,447	0,22	21,86	101,345	0,22	22,44	103,259	0,22	22,12
Total		387,595			482,476			451,564			466,824		

As the table aforementioned illustrates, 62.43% of the 387,595 words of the Ceramic Materials sub-corpus, 61.45% of the 482,476 words of the Materials Science sub-corpus, 61.39% of the 451,564 words of the Metallurgy sub-corpus, and 60.02% of the 466,824 words of the Polymer Science and Technology sub-corpus can be found in the GSL 1st 1000 words, which are the most frequently encountered words in the English language. The GSL 2nd 1000 words encompass 6.82% of the 387,595 words in the Ceramic Materials sub-corpus, 6.65% of the 482,476 words in the Materials Science sub-corpus, 6.47% of the 451,564 words in the Metallurgy sub-corpus, and 7.35% of the 466,824 words in the Polymer Science and Technology sub-corpus. 9,47% of the 387,595 words in the Ceramic Materials sub-corpus, 10.04% of the 482,476 words in the Materials Science sub-corpus, 9.70% of the 451,564 words in the Metallurgy sub-corpus, and 10.51% of the 466,824 words in the Polymer Science and Technology sub-corpus are among the AWL of Coxhead. The first three levels, in turn, make up 78.72% of the Ceramic Materials sub-corpus, 78.14% of the Material Science sub-corpus, 77.56% of the Metallurgy sub-corpus, and 77.88% of the Polymer Science and Technology sub-corpus. The remaining 82,477 words from the Ceramic Materials sub-corpus, 105,447 words from the Material Science sub-corpus, 101,345 words from the Metallurgy sub-corpus, and 103,259 words from the Polymer Science and Technology sub-corpus fall into the level "5" or "not in the lists" category. Consequently, these terms are the primary subject of this thesis and have the potential to be technical terms.

In addition to being impractical for educational purposes, a list with this many words makes it impossible to determine whether all of them are truly technical terms (Ward, 2009). Therefore, it was necessary to reevaluate and minimize the "not in the lists" words for each sub-corpus. As stated in the methodology section, the researcher's initial action was to choose the top 800 words for each word list according to their frequency. Appendix 11 contains the complete lists along with their frequencies. Subsequently, the researcher uploaded the three discipline-specific dictionaries and four word lists to the GenAI "Gemini" and instructed the GenAI "Gemini" to identify the words listed in the discipline-specific dictionaries. After manually going over the GenAI-generated word lists by consulting dictionaries, the researcher removed words that were not listed in the three discipline-specific dictionaries. An expert and a technician in the field were consulted once the word lists were developed. The lists were rendered available to them, and they gave approval for the words' importance and usage in the field. As a result, word lists covering the first 200 words for each sub-corpus were created. In order to generate a word list that included common words across four word lists, the researcher uploaded the finished word list to the GenAI "Gemini" and asked it to identify the common words. Tables 6, 7, 8, 9, and 10 respectively show the Ceramic Materials Word List (CMWL), Material Science Word List (MSWL), Metallurgy Word List (MWL), Polymer Science and Technology Word List (PSTWL), and Common Words Word List.

Knowing the vocabulary in these lists also makes it simpler for EAP students to search and master collocations—word combinations related to their particular areas. For EAP students, learning word combinations has significant advantages for their academic careers. One such advantage is having native-like fluency and accuracy. Native speakers naturally and instinctively put words together in collocations. EAP students can enhance the naturalness, sophistication, and authority of their writing by being aware of these pairings. The use of improper collocations can indicate that a speaker is not native and diminish the academic work's professionalism (Demir, 2018). Additionally, being aware of these words' collocations will enhance both the efficiency and flow of the EAP students' academic writing. Knowing common collocations assists students in writing more efficiently since they spend less time looking for the proper words. As a result, this makes their essays, reports, and dissertations easier to read and more coherent. By comprehending the collocations of these words, EAP students may additionally benefit from a boost in their linguistic repertoire. By emphasizing collocations, students active and passive vocabulary spontaneously grows. Along with learning the meaning of individual words, they also learn the semantic links between them and their common companions (Asadova, 2024). In order to demonstrate various collocations and their usage within sentences, the five distinct most frequent words from each list were identified based on their frequency. Three unique word combinations derived from these words were subsequently supplied to GenAI "Gemini" to produce sentences pertaining to their specific fields. From Table 6, "Thermal", "Strength", "Ceramic", and "Density"; from Table 7, "Alloy", "Fatigue", "Steel", "Microstructure", and "Welding"; from Table 8, "Leaching", "Matrix", "Carbon", "Composite", and "Concentration"; and from Table 9, "Fiber", "Thermal", "Resin", "Polymer", and "Strain" were selected. Below their corresponding tables are the word combinations of these words and sentences generated by GenAI "Gemini".

Table 6: Ceramic Materials Word List

Words	Freq	Range	Words	Freq	Range
Thermal	768	69	Carbide	72	21
Strength	632	55	Spinel	70	10
Ceramic	512	57	Silicate	69	20
Sintering	478	51	Additive	68	19
Density	466	68	Thermogravimetric analysis (TGA)	67	12
Conductivity	457	38	Titanium	67	18
Porosity	359	57	Zinc	66	12
Matrix	336	54	Hydroxide	66	16
Microstructure	300	58	Calcite	65	7
Laser	295	29	Membrane	65	4
Alumina	276	39	Nucleation	64	11
Compressive	267	23	Purity	63	30
Cement	241	21	Cathode	63	7
Crystalline	239	47	Precursors	63	14
Composites (material)	237	26	Magnesia	62	9
Corrosion	233	23	Slag	62	16
Absorption	231	28	AC	61	8

Table 6: (Continued)

Words	Freq	Range	Words	Freq	Range
Ion	229	38	Alloy	61	5
Electron	227	75	Atom	61	24
Magnesia (MgO)	220	20	Deformation	61	16
Fracture	212	26	Evaporation	60	16
Concentration	207	45	Deposition	59	16
Oxide	206	57	Polycrystalline	59	14
Diffraction	201	68	Ablation	58	6
Scanning electron microscopy (SEM)	201	56	Brazing	58	2
Oxygen	200	40	Castable	58	8
Refractory	199	23	Calcination	57	14
Carbon	193	46	Batch	56	14
Lattice	186	33	Refractive index	56	3
Mole (Mol)	185	30	Debond	56	1
Specimen	185	34	Coating	55	20
Calcium	183	27	Carrier	55	10
Crystal	166	41	Pellet	55	17
Fiber/Fibre	165	11	Cementitious	53	10
Furnace	157	60	Flux	53	12
Amorphous	157	30	Hydration	53	16
Pore	155	25	Applicator	51	1
Phosphate	150	10	Vapor	51	16
Coefficient	134	28	Wettability	51	4
Inclusion	132	5	Polymer	50	14
Morphology	128	47	Refractories	50	14
Crystallization	127	21	Fatigue	49	4
Viscosity	126	26	Cavity	48	3
Spectroscopy	126	49	Infrared	48	20
Porous	124	27	Cubic	47	15
Magnesium (MG)	122	35	Inert	47	21
Strain	121	21	Leaching	47	9
Molar	121	19	Vacuum	46	27
Defect	121	33	Homogeneous	46	23
Activation	121	22	Bauxite	45	10
Decomposition	120	26	Indentation	44	4
Densification	119	24	Alkaline	44	12
Iron (Fe)	117	22	Impedance	43	12
Aluminum	115	29	Inorganic	42	20
Cell	114	26	Infiltration	41	12
Bubble	110	4	Ultraviolet (UV)	41	40
Filler	109	11	Alpha (a)	40	18
Fraction	109	30	Precipitation	40	14
Oxidation	108	34	Crucible	40	16
Quartz	108	21	Eutectic	39	6

Table 6: (Continued)

Words	Freq	Range	Words	Freq	Range
Polymethyl methacrylate (PMMA)	108	5	Anisotropic	38	8
Shear	105	12	Adsorption	38	14
Glaze	104	3	Solidification	38	10
Carbonate	103	13	Stoichiometric	37	17
Shrinkage	103	25	Mullite	36	13
Atmosphere	102	36	Aqueous	36	18
Silica	97	29	Equilibrium	35	13
Interface (composites)	97	26	Electrolyte	35	5
Calcined	94	21	Vibration	34	17
Electrode (welding)	94	11	Radius	34	20
Doping	94	16	Phosphor	34	2
Degradation	93	22	Exothermic	33	11
Magnetic	93	20	Potassium	33	7
Microscopy	92	49	Blend	33	8
Activated	90	14	Ambient	32	20
Dissolution	88	21	Sealant	32	1
Emission	87	21	Perovskite	32	8
Nitrogen	87	30	Attenuation	31	4
Sodium	86	19	Octahedral	31	12
Gel (polymers)	86	12	Isothermal	31	11
Pyrolysis	86	11	Spectrometer	31	24
Graphite	85	17	Feldspar	30	6
Irradiation	84	9	Solvent	30	11
Interfacial tension	84	15	Annealing (abrasives)	30	10
Mesh	83	15	Casting	30	12
Diffusion	82	32	Polyphenylene sulfides (PPS)	30	1
Polarization	82	12	Nominal	30	11
Impurities	82	31	Ferroelectric	29	5
Acid	81	26	Granular	29	9
Organic	81	25	Homogeneity	28	15
Silicon	80	30	Magnification	28	18
Flexural Strength	78	11	Niobium	28	4
Excitation	77	11	Valence	27	12
Hydrogen	76	15	Permittivity	27	5
pH	76	17	Filter	26	12
Thermocouple	75	8	Dopant	26	9
Magnesium	74	14	Chromium	26	6
Thermodynamic	74	18	Quench	23	13
Alkali	72	12	β (beta)	20	13
Microscope	72	46	SIALON	14	1

Table 6 showcases a list of the two hundred most frequently used discipline-specific terms in the Ceramic Materials sub-corpus of Meta-MatCorp. This list was compiled after consulting three discipline-specific dictionaries and an expert and a technician in the field to determine whether the words were discipline-specific. 387,595 words and 100 articles about the field of Ceramic Materials published in SCI-indexed journals constitute the Ceramic Materials sub-corpus of Meta-MatCorp. Table 6 shows that the word “thermal” is the most commonly used word in the Ceramic Materials sub-corpus, with a frequency of 768. “Strength” is the second most frequently used word, with a frequency of 632, followed by “ceramic” at 512, “sintering” at 478, and “density” at 466. For EAP students majoring Metallurgical and Materials Science Engineering, these words and their numerous word combinations are quite valuable. Examples of word combinations and how they are utilized in GenAI-generated sentences are shown below.

4.1.1. Ceramic Materials Word List – Word Combination Examples

Although individual technical vocabulary items rather than multi-word phrases were the main focus of the thesis, five words with the highest frequency were chosen from the CMWL and submitted to GenAI "Gemini" in order to gain a greater awareness of how these terms typically appear in context. The researcher subsequently instructed GenAI "Gemini" to provide three sentences for each of the five words that contained multi-word phrases.

4.1.1.1. Thermal

- Ceramic engineers often utilize **thermal analysis** techniques, such as dilatometry and DTA, to understand how new compositions will respond to high temperatures during processing.
- The **thermal behavior** of a ceramic composite, particularly its coefficient of thermal expansion, is crucial for predicting its performance and preventing failure in extreme temperature environments.
- Defect mobility and grain growth in many advanced ceramics are strongly governed by **thermal activation**, requiring sufficient energy to overcome energetic barriers.

4.1.1.2. Strength

- The excellent mechanical properties of toughened ceramics are often attributed to the high **strength achieved** through careful control of microstructure and grain boundary engineering.
- Understanding the **strength characteristic** of a new ceramic material under various loading conditions is critical for its reliable application in structural components.

- The **strength development** in sintered ceramics is significantly influenced by factors such as sintering temperature, duration, and the presence of sintering aids, all of which impact density and grain growth.

4.1.1.3. Ceramic

- The miniaturization of electronic devices has been significantly driven by the widespread use of the **ceramic capacitor**, known for its high capacitance density and stability.
- In solid oxide fuel cells, the **ceramic cathode** plays a crucial role in the oxygen reduction reaction, directly impacting the cell's efficiency and power output.
- Virtually every modern electronic and mechanical system incorporates at least one **ceramic component**, benefiting from ceramics' superior hardness, chemical inertness, and thermal stability.

4.1.1.4. Sintering

- The carefully controlled **sintering process** transforms a porous "green" ceramic body into a dense, strong, and durable material by applying heat below its melting point.
- To achieve desired microstructures and lower sintering temperatures, a specific **sintering additive**, such as yttria or magnesia, is often incorporated into the ceramic powder mixture.
- The choice of **sintering atmosphere**, whether inert, oxidizing, or reducing, significantly influences the densification kinetics, grain growth, and final properties of the ceramic material.

4.1.1.5. Density

- If excessive porosity forms during the sintering process, the overall **density decreases**, leading to a reduction in the ceramic's mechanical strength and performance.
- Accurate **density measurement** is a critical quality control step in ceramic manufacturing, ensuring that components meet specifications for strength and functionality.
- The **density fraction** of a ceramic composite, representing the ratio of its actual density to its theoretical maximum density, is a key indicator of the efficiency of the densification process.

The two hundred discipline-specific words that are most frequently employed in the Material Science sub-corpus of Meta-MatCorp are listed in Table 7. Three discipline-specific dictionaries and a subject-matter expert were consulted in order to ascertain whether the words on this list were discipline-specific. The Material Science sub-corpus of Meta-MatCorp consists of 100 papers about the area of Material Science published in SCI-indexed journals, totaling 482,476 words.

Table 7: Material Science Word List

Word	Freq	Range	Word	Freq	Range
Alloy	951	45	Stainless	68	18
Strength	842	76	Organic	66	22
Fatigue	658	15	Brittle	66	24
Steel	608	45	Forging	66	6
Microstructure	587	69	Rivet	66	2
Density	561	75	Recrystallization	65	9
Welding	470	20	Graphite	65	23
Matrix	468	57	Mole (Mol)	64	15
Deformation	458	53	Silicon	64	13
Interface	458	47	Boron	60	6
Strain	448	44	Atmosphere	60	34
Composite	423	31	Spectroscopy	60	37
Thermal	364	62	Annealing	60	16
Fracture	359	39	Equilibrium	59	18
Eutectic	341	9	Catalyst	59	9
Laser	330	27	Segregation	59	22
Electron	322	77	Pellet	58	6
Titanium	317	21	Evaporation	58	9
Pore	308	32	Furnace	57	28
Carbon	278	42	Homogeneous	56	28
Conductivity	277	34	Nitrogen	56	19
Porosity	276	25	Decomposition	56	20
Concentration	276	51	Capacitance ©	55	5
Specimen	258	39	Aniline	54	1
Crystal	234	51	Martensitic	54	8
Friction	234	19	Activation	54	29
Dislocation	231	22	Vickers hardness number (HV)	53	22
Plastic	230	43	Crystallinity	53	14
Diffusion	227	39	Spectrum	53	20
Lattice	227	44	Magnesium	53	12
Sintering	223	27	Emission	51	25
Weld	222	10	Plasma	51	23
Micrometer (μm)	218	38	Tungsten	51	8
Aluminum	216	20	Resin	51	6
Electrode	213	12	Combined Carbon (CC)	51	7
Cell	200	28	Algorithm	51	12
Coefficient	194	39	Adhesive	50	8
Oxide	188	31	Elongation	50	16
Morphology	186	50	Valence	49	21
Austenite	185	13	Kiln	49	3

Table 7: (Continued)

Word	Freq	Range	Word	Freq	Range
Magnesium (Mg)	181	25	Slag	48	6
Magnetic	180	16	Nickel	48	12
Atom	179	37	Polarization	48	11
Compressive	178	20	Solute	48	10
Martensite	169	14	Resistivity	48	9
Ceramic	167	16	Dopant	47	8
Shear	163	31	Amorphous	47	17
Residual	158	33	Electromagnetic Interference	46	10
Defect	158	43	Fusion	46	14
Diffraction	157	61	Deposition	46	21
Fraction	157	35	Metastable	46	12
Alpha (a)	155	20	Crystallization	46	8
Oxygen	152	29	Crystalline	45	28
Microscopy	141	55	Irradiation	45	13
Oxidation	140	30	Battery	45	7
β (beta)	139	13	Nitriding	45	3
Ion	137	28	Cement	44	5
Ductility	137	30	Bainite	44	6
Metallurgy	130	27	Ultraviolet (UV)	43	11
Polymer	124	16	Magnesia (MgO)	43	7
Adhesion	124	17	Heterogeneous	43	17
Corrosion	121	26	Alignment	43	5
Absorption	119	27	Aqueous	42	12
Polymerization	117	5	Increment	42	12
Doping	116	18	Electron spin resonance (ESR)	42	1
Inclusion	111	8	X-ray photoelectron spectroscopy (XPS)	41	11
Vacuum	109	42	Semiconductor	40	17
Densification	107	13	Molecule	40	16
Acid	107	23	Membrane	40	9
Substrate	106	27	Abrasive	39	6
Clinker	106	1	Compact	39	8
Carrier	106	14	Filler	38	4
Intermetallic	100	16	Compaction	38	10
Adsorption	100	16	Electrolyte	38	6
Precipitation	96	25	Template (templet)	36	5
Hydrogen	96	26	Brazing	36	6
Vibration	96	12	Ultimate tensile strength (UTS)	35	8
Shrinkage	95	14	Lamellae	35	7
Hybrid	92	12	Bubble	35	7
Ferrite	91	9	Gel (polymers)	34	10
Microscope	91	41	Chromium	34	7
Alumina	86	14	Impurities	34	16
Debris	85	6	Cast	33	13

Table 7: (Continued)

Word	Freq	Range	Word	Freq	Range
Hydration	84	3	Coarsening	33	10
Casting	83	17	Maraging	32	3
Precipitate	83	18	Total Carbon (TC)	32	8
Porous	81	19	Ligand	32	5
Metal-Matrix Composites (MMC)	79	3	Ladle	31	3
Plasticity	78	13	Gas chromatography (GC)	31	2
Phosphorus	78	5	Penetration	30	15
Extrusion	77	8	Superalloy	30	5
Carbide	75	20	Precursor	29	14
Solidification	74	13	Viscosity	29	5
Brake	74	2	Normal direction (ND)	28	6
Fiber	73	18	Secondary electron (SE)	27	10
Keyhole	73	3	Pixel	23	4
Nucleation	73	19	Axis (crystal)	21	16
Interfacial tension	73	21	Grain boundary (GB)	12	6
pH	71	14	Perovskites	5	3
Inorganic	70	16	Anneal	2	2

At a frequency of 768, the word "alloy" is the most often used word in the Material Science sub-corpus, according to Table 7. With a frequency of 842, "strength" is the second most used word, followed by "fatigue" (658), "steel" (608), and "density" (561). These words, along with their various word combinations, are extremely beneficial to EAP students pursuing education in Metallurgical and Materials Science Engineering. Below are some examples of word combinations and their functions in sentences produced by GenAI "Gemini".

4.1.2. Material Science Word List – Word Combination Examples

Even though the study primarily concentrated on individual technical vocabulary items rather than multi-word phrases, five words with the highest frequency were selected from the MSWL and submitted to GenAI "Gemini". Due to the potential similarity of certain high-frequency terms to those in other word lists, they were excluded, and subsequent items from the list were chosen instead. The researcher prompted GenAI "Gemini" to generate three sentences for each of the five words that included multi-word phrases to enhance contextual understanding.

4.1.2.1. Alloy

- The precise **alloy composition** is meticulously chosen by material scientists to achieve a specific balance of mechanical, electrical, and thermal properties for a given application.

- Advanced computational tools are increasingly being employed in **alloy design** to predict novel material combinations and accelerate the discovery of high-performance metallic systems.
- In many surface engineering applications, the controlled formation of a thin **alloy layer** on a substrate can dramatically enhance properties like corrosion resistance or wear durability.

4.1.2.2. Fatigue

- Under cyclic loading, a microscopic **fatigue crack** can initiate at stress concentrations and progressively grow, eventually leading to structural failure.
- Accumulated **fatigue damage** in a material, even at stresses below its yield strength, can significantly reduce its service life and necessitate stringent inspection protocols.
- The catastrophic failure of many engineering components can be attributed to **fatigue fracture**, a phenomenon characterized by brittle-like behavior with distinct microscopic features despite often occurring under ductile conditions.

4.1.2.3. Steel

- The mechanical integrity of a **steel weldment** is highly dependent on the welding parameters and subsequent heat treatment, which influence its microstructure and residual stresses.
- Before a new material is approved for an application, a **steel specimen** undergoes rigorous testing, including tensile, impact, and fatigue tests, to characterize its mechanical properties.
- High-strength, low-alloy (HSLA) **steel alloy** formulations are continuously being developed to meet the demanding requirements of industries such as automotive and construction, offering excellent strength-to-weight ratios.

4.1.2.4. Microstructure

- The **microstructure characteristic** of a material, including grain size, phase distribution, and defect density, is a primary determinant of its macroscopic properties.
- During processing, understanding the **microstructure evolution** is crucial for tailoring the final properties of metals, ceramics, and polymers.
- In multiphase materials, the **microstructure fraction** of each constituent phase significantly impacts the overall mechanical response and performance of the alloy or composite.

4.1.2.5. Welding

- Optimizing each **welding parameter**, such as current, voltage, and travel speed, is essential to achieve a defect-free joint with desired mechanical properties.
- The choice of **welding position**, whether flat, horizontal, vertical, or overhead, significantly influences molten pool control and bead shape, which in turn affects the quality of the weld.
- The selection of the appropriate **welding process**, be it TIG, MIG, or arc welding, depends heavily on the material type, thickness, and the required integrity of the final product.

A list of the two hundred discipline-specific words that are most frequently encountered in the Metallurgy sub-corpus of Meta-MatCorp is presented in Table 8. To ascertain whether the words were discipline-specific, this list was put together after examining three discipline-specific dictionaries and consulting an expert on the topic. The Metallurgy sub-corpus under Meta-MatCorp consists of 100 articles that were published in SCI-indexed journals and 451,564 words pertaining to the topic of metallurgy.

Table 8: Metallurgy Word List

Words	Freq	Range	Words	Freq	Range
Alloy	1076	52	Vickers (hardness) test	63	18
Leaching	799	22	Defect	63	28
Density	624	64	Alumina	63	20
Sintering	619	40	Nitrogen	60	21
Matrix	570	52	Electrode (welding)	59	14
Microstructure	534	54	Spinel	59	4
Carbon	489	47	Equiaxed	57	17
Composite	478	16	Liquidus	57	6
Concentration	466	60	Ingot	57	11
Fracture	460	40	Drill	56	2
Acid	456	47	Flux	55	12
Deformation	450	40	Sulphur	54	9
Metallurgy	450	61	Ferrite	53	11
Alpha (α)	437	18	Graphite	52	21
Slag	421	17	Scrap	52	7
Micrometer(µm)	395	62	Ultrasonic	52	8
MPa	382	44	Lime	51	12
Oxygen	382	45	Forging	51	7
pH (value)	381	21	Evaporation	51	10
Ore	378	25	Texture	50	14
Strain	366	31	Uniaxial	50	11
Titanium	348	29	Galena	49	2
Interface	326	39	Lithium	48	3

Table 8: (Continued)

Words	Freq	Range	Words	Freq	Range
Furnace	296	46	Zircon	47	1
Corrosion	289	36	Superalloys	47	6
Fatigue	268	16	Dimples/ing	47	15
Coating	266	13	Coarsening	46	15
Oxide	252	46	Fusion	45	10
Weld	249	8	Substrate	45	13
Hydrogen	245	23	Crucible	45	14
Porosity/Pore	228	29	Plasma	44	27
Compact	224	13	Granulation	44	2
Diffusion	222	42	Situ (In situ)	43	8
Electron	217	72	Converter	43	8
Dislocation	212	29	Cast	42	11
Magnetic	200	14	Germanium	42	2
Coke	198	9	Segregation	42	14
Feed	198	19	Arc	41	15
Vacuum	197	43	Filler	41	7
Ion	196	22	Slurry	40	12
Morphology	190	51	Acicular	40	9
Microhardness	190	20	FCC	37	8
Dissolution	186	31	Argon	37	23
Matte	180	5	Stud	37	1
Laser	174	23	ASTM	36	20
Nickel	165	11	AC	35	4
Coefficient	162	32	Magnification	35	18
Precipitate	156	23	Thermodynamics	35	13
Brittle	151	28	Preheating	35	1
Zinc	147	16	Boron	35	5
Calcium	147	14	Aqueous	35	9
Smelting	147	20	Blasting	33	2
Oxidation	144	35	Chip	32	4
Residual	140	28	Spectrometer	32	24
Plastics	136	38	Aluminium	32	9
Adsorption	136	12	Heat affected zone (HAZ)	31	5
Hematite	129	11	Facet	31	5
Manganese	129	9	Potassium	30	11
Recrystallization	129	15	Ligament	30	1
Friction	128	22	Fluid	30	13
Diffraction	128	54	Activated	30	16
Ductility	123	27	Mesh	29	13
Magnesium	118	17	Wrought	28	6
Carbide	115	22	Susceptibility	28	10
Crystal	115	38	Crystalline	27	12
Stainless	114	18	Abrasion	26	9
Shear	113	24	Pyrites	26	4

Table 8: (Continued)

Words	Freq	Range	Words	Freq	Range
Microscope	113	55	Lubricant	26	7
Phosphorus	108	8	Absorption	26	13
Elongation	108	19	Twin	25	4
Ceramic	107	22	Limestone	25	3
Austenite	100	7	Build-up	25	2
Atom	91	20	Solvent	24	10
Equilibrium	89	28	Refractory	24	11
Silicon	89	12	Penetration	24	16
Martensite	89	11	Methane	24	5
Calcite	88	5	Lamellae	24	4
Voidage	88	1	Cathode	23	7
Microscopy	88	46	Filtration	23	12
Tungsten	86	9	Resistivity	23	4
Alkali	86	8	Silicate	22	11
Vanadium	84	7	Shrinkage	22	6
Silica	82	17	Fluorescence	22	14
Solidification	81	19	Binary	22	8
Densification	79	16	Bellows	22	1
Machinability	77	3	Solute	21	8
Cell	76	16	Annealing	21	9
Eutectic	75	15	Plasticity	21	8
Magnetite	72	10	Mullite	21	2
Lattice	72	25	Flakes	20	4
Conductivity	72	18	Isostatic	20	8
Electrolyte	69	7	Electrowinning	20	5
Chromium	68	12	Cleavage	19	11
Tailings	68	5	Anion	18	4
Quartz	67	19	Sigma (phase)	18	7
Propagation	67	18	Braze	15	3
Anode	67	8	Macro	15	7
Nucleation	66	23	ISO	12	5
Sodium	65	16	Quench	12	2
Clad	65	1	Battery	9	4

According to Table 8, with a frequency of 1076, the word “alloy” is the most frequently employed word in the Metallurgy sub-corpus. With a frequency of 799, the word “leaching” is the second most employed, being followed by “density” at 512, “sintering” at 619, and “matrix” at 570. Metallurgical and Materials Science Engineering majors can benefit considerably from these words and their many word combinations. The examples of word combinations and how they act in GenAI-generated sentences are provided below.

4.1.3. Metallurgy Word List – Word Combination Examples

Despite the fact that the study focused more on single technical vocabulary items than multi-word phrases, the five most often occurring words were chosen from the MWL and uploaded into GenAI "Gemini". Some high-frequency terms were eliminated because they might be comparable to terms in other word lists; instead, following terms were selected from the list. To improve contextual comprehension, the researcher asked GenAI "Gemini" to produce three sentences for each of the five words, including multi-word phrases.

4.1.3.1. Leaching

- The **leaching efficiency** in hydrometallurgical processes is a critical factor determining the economic viability of extracting valuable metals from ores.
- Optimizing the **leaching conditions**, including temperature, pressure, and particle size, is essential to maximize metal recovery and minimize energy consumption.
- A strong acidic or basic solution is typically employed as the **leaching agent** to dissolve the target metal compounds from the raw ore materials.

4.1.3.2. Matrix

- In a metal **matrix composite**, the properties of the overall material are significantly enhanced by reinforcing a metallic matrix with high-strength fibers or particles.
- Researchers are investigating novel designs where a **matrix channel** could be engineered within an alloy to facilitate the transport of specific elements or to improve cooling efficiency.
- The mechanical behavior and performance of many alloys are largely governed by the characteristics of the primary **matrix phase** and how secondary phases are distributed within it.

4.1.3.3. Carbon

- The **carbon content** in steel is a primary determinant of its hardness, strength, and weldability, with higher percentages generally leading to increased strength but reduced ductility.
- In certain high-temperature metallurgical processes, unwanted **carbon deposition** on furnace walls or catalyst surfaces can reduce efficiency and necessitate frequent cleaning.
- The steel industry is actively investing in new technologies and processes to reduce its significant **carbon emission** footprint, aiming for more sustainable production methods.

4.1.3.4. Composite

- A meticulously prepared **composite specimen** is often subjected to various mechanical tests to evaluate the synergistic properties achieved by combining different constituent materials.
- Researchers frequently prepare a **composite sample** with varying fiber orientations or particle distributions to study the effect of microstructure on overall material performance.
- A well-designed metal **composite exhibits** superior strength-to-weight ratios and enhanced fatigue resistance compared to its monolithic metallic constituents, making it ideal for aerospace applications.

4.1.3.5. Concentration

- In stress analysis, the **concentration factor** is used to quantify how localized stresses are magnified at geometric discontinuities, which is critical for designing robust metallic components.
- During solidification of an alloy, a **concentration gradient** of solute atoms can develop between the solid and liquid phases, influencing the microstructural evolution and ultimately the mechanical properties.
- In electrochemical processes like electrowinning or corrosion, **concentration polarization** can occur at the electrode surface due to the depletion or buildup of reacting species, limiting the reaction rate.

The most prominent two hundred discipline-specific words in the Polymer Materials and Technology sub-corpus of Meta-MatCorp are displayed in Table 9. After determining if the words were discipline-specific by consulting three discipline-specific dictionaries and an authority on the subject, this list was created. The Polymer Materials and Technology sub-corpus of Meta-MatCorp consists of 100 papers published in SCI-indexed journals and spanning 466,824 words.

Table 9: Polymer Science and Technology Word List

Words	Freq	Range	Words	Freq	Range
Composites	1627	69	Thermoplastic polyimides (TPI)	61	2
Fiber (Composites)	1263	59	Inorganic	60	23
Strength	1195	91	Fiber-reinforced plastic (FRP)	58	8
Matrix	1031	83	Corrosion	57	20
Thermal (conductivity)	792	75	Oxidation	57	20
Resin	674	51	Rib (plastics)	57	3
Polymer	627	88	Precursors	57	2

Table 9: (Continued)

Words	Freq	Range	Words	Freq	Range
Strain	592	55	Ceramic	56	12
Filler	515	41	Humidity	55	19
Carbon	513	68	X-ray photoelectron spectroscopy (XPS)	52	15
Specimen	443	56	Homogeneous	51	27
Friction	413	28	Abrasion	51	12
Hybrid	409	39	Catalyst	50	7
Dielectric	402	13	Lubricant	50	5
Fracture	359	56	Substrate	50	23
Conductivity	357	33	Bridging	48	6
Deformation	349	57	Ply	48	15
Shear	339	45	Alpha (α)	47	19
Absorption	324	50	Configurations	47	16
Laminate	289	28	Hydrophobic	46	17
Coating	282	26	Weft	46	9
Aramid	226	10	Titanium	46	8
Acid	225	45	Segment	46	14
Compressive	221	28	Microscopic	46	17
Magnetic	219	26	Piezoelectric	45	5
Viscosity	215	32	Warp	44	9
Adhesion	204	48	Aluminum	44	21
Degradation	195	42	Foaming	44	4
Micrometer(μm)	189	45	Atmosphere	44	31
Dispersion	184	41	Silica	43	10
Adhesive	180	38	Graft (Copolymers)	43	4
Mold (plastics)	174	36	Wicking	43	1
Molding (plastics)	161	40	Fatigue	43	15
Toughness	157	32	Equilibrium	42	17
Polypropylenes (PP)	154	18	Brake	42	3
Graphite	153	21	Acrylonitrile-Butadiene-Styrene (ABS)	41	4
Yarn	149	9	Gel (polymers)	41	15
Cell	147	28	Deposition	41	12
Elongation	144	39	Analyzer	40	24
Membrane	144	8	Ultraviolet (UV)	39	11
Silicones (SI)	142	14	Polyol	39	3
Crystallization	141	13	Isocyanate (plastics)	39	4
Delamination	141	24	Hydrophilic	39	12
Etching	137	5	Phenolic	38	9
Polyamide-imide (PAI)	137	2	Slurry	38	5
Decomposition	129	30	Spectrometer	38	21
China	125	39	Tack	37	2
Plasma	121	9	Antioxidant	36	6
Polymerization	121	25	Concrete	36	4

Table 9: (Continued)

Words	Freq	Range	Words	Freq	Range
Fraction	119	36	High-Density Polyethylene (HDPE)	36	7
Electron	118	57	Damping	35	13
Interlaminar	117	12	Flux	35	5
Kevlar	116	11	Polycarbonates (PC)	34	5
Molecule	115	36	Deflection	34	10
Crystal	113	20	Lubrication	34	5
Plastic	113	33	Brittle	34	21
Polyether-imide (PEI)	112	1	Nuclear magnetic resonance (NMR)	33	8
Vacuum	111	42	Bubble	33	3
Polyethylene (PE)	111	6	Irradiation	33	8
Fourier transform infrared (FTIR)	110	30	Polyphenylene oxides (PPO)	32	1
Spectrum	107	33	Alignment	32	11
Adsorption	107	12	Filter	32	6
Crystallinity (plastics)	106	21	Increment	32	19
Crystalline	103	20	Vulcanization	32	4
Differential scanning calorimetry (DSC)	100	25	Wettability	32	12
Buckling	96	8	Cavity	31	8
Porosity	94	20	Atom	30	16
Molecular weight (MW)	94	13	Blend	30	12
X-ray diffraction (XRD)	92	22	Hardener	30	11
Hydrogen	88	28	Polymethyl methacrylate (PMMA)	30	6
Polyetheretherketone (PEEK)	85	6	Abrasive	29	8
Microscopy	84	43	Vapor	28	9
Ablation	84	3	Flake (plastics)	28	10
Hydroxyl	83	27	Attenuation	28	5
Thermoplastic	80	26	Polyolefins	28	3
Lattice	80	9	Flask	28	13
Amorphous	78	18	Casting	27	10
Extrusion (plastics)	77	21	Reagent	27	19
Strand	77	6	Extruder	27	10
Laser	76	14	Functionality	26	12
Mesh	76	24	Macroscopic	26	15
Microstructure	76	21	Brittleness	25	16
Parts per million (PPM)	75	12	Aromatic	25	15
Additive	74	23	Situ (In situ)	25	12
Solvent	73	23	Resistivity	25	7
Copolymer	71	13	Pyrolysis	25	6
ph	70	20	Heterogeneous	25	15
Diluent	69	3	Blending	24	15

Table 9: (Continued)

Words	Freq	Range	Words	Freq	Range
Pore	69	13	Shrinkage	24	12
Alloy	68	5	Ester	24	11
Infrared (IR)	68	40	Emission	24	16
Void	66	28	Node	23	5
Jute	65	8	Ion	22	10
Polyurethanes (PUR)	65	4	Polyamides (PA)	18	12
Organic	65	32	Isotropic	14	4
Penetration	64	17	Axis	13	11
Breakdown	64	9	Dual phase (DP)	11	3
Spectroscopy	63	33	Impregnation	10	6
Defect	63	33	Cast	8	8
β (beta)	61	15	Single crystal (SC)	7	2

Table 10: Common Words List

Acid	Composite	Filler	Microscopy
Adsorption	Conductivity	Fracture	Microstructure
Alloy	Corrosion	Graphite	Oxidation
Alpha (α)	Crystal	Hydrogen	Pore / Porosity
Aluminum (Aluminium)	Crystalline	Interface	Shear
Atom	Defect	Ion	Strain
Carbon	Deformation	Laser	Titanium
Cell	Electron	Lattice	Vacuum
Ceramic	Equilibrium	Magnetic	
Coating	Fatigue	Matrix	

Table 9 illustrates that the word “composites” is the most frequently encountered word in the Polymer Science and Technology sub-corpus, occurring 1627 times. “Fiber” has the second-highest frequency (1263), closely followed by “strength” (1195), “matrix” (1031), and “thermal” (792). For EAP students seeking education in Metallurgical and Materials Science Engineering, these words and their different word combinations are extremely valuable. Examples of word combinations and their intended usage in sentences generated by GenAI “Gemini” are shown below.

4.1.4. Polymer Science and Technology Word List – Word Combination Examples

The study focused on single technical vocabulary items rather than multi-word phrases; however, five of the most frequently occurring terms were chosen from the MSWL and uploaded into GenAI “Gemini”. Certain high-frequency terms were eliminated because they might be comparable to terms in other word lists; instead, subsequent words were chosen from the list. Using multi-word phrases to improve contextual awareness, the researcher prompted GenAI “Gemini” to produce three sentences for each of the five words.

4.1.4.1. Fiber

- In fiber-reinforced polymer composites, understanding the mechanisms of **fiber fracture** is crucial for predicting the overall mechanical performance and designing more resilient materials.
- The mechanical properties of a polymer composite are highly anisotropic and depend critically on the **fiber orientation** within the polymer matrix.
- Many high-performance polymer ropes and textiles derive their strength from carefully arranged **fiber bundles**, where individual filaments work synergistically to bear loads.

4.1.4.2. Thermal

- The low **thermal conductivity** of many polymers makes them excellent candidates for insulation applications in buildings and electronic devices.
- In designing heat sinks for electronic components, engineers must consider the **thermal resistance** of the polymer encapsulants to ensure efficient heat dissipation.
- High-performance polymers are often selected for applications requiring elevated temperatures due to their superior **thermal stability**, allowing them to maintain their mechanical properties without decomposing.

4.1.4.3. Resin

- In composite manufacturing, the **resin matrix** encapsulates and binds together the reinforcing fibers, playing a critical role in load transfer and overall material performance.
- After the curing process, minimizing **resin residue** on the surface of a polymer component is important for achieving desired aesthetic qualities and ensuring proper adhesion in subsequent assembly steps.
- Careful control of the **resin viscosity** is essential during processes like resin transfer molding, as it directly impacts the ability of the resin to impregnate fiber preforms without voids.

4.1.4.4. Polymer

- In block copolymers, the segregation into distinct microdomains often results in a well-defined **polymer phase** separation, influencing the material's properties.
- The entanglement and cross-linking of **polymer chains** are fundamental to determining a material's elasticity, strength, and overall mechanical behavior.

- A protective **polymer coating** is frequently applied to metal surfaces to enhance corrosion resistance, improve aesthetics, and provide electrical insulation.

4.1.4.5. Strain

- The mechanical response of viscoelastic polymers is highly dependent on the **strain rate**, with materials often exhibiting stiffer behavior under faster deformation.
- A **strain gauge** is a common instrument used in polymer testing to precisely measure the deformation of a material when subjected to various mechanical loads.
- Analyzing the stress-**strain curve** of a polymer provides critical information about its elastic modulus, yield strength, and ultimate tensile strength, which are essential for material selection and product design.

4.2. Classroom Activities and Participants Performance

To generate classroom activities, the researcher utilized GenAI "Gemini" based on one of the four word lists created through frequency analysis and expert judgment. To decide which of the word lists would be utilized to produce the classroom activities, the random sampling method was used. The 200-word Metallurgy Word List was picked. Appendix 5 lists the 200 terms that were used in the creation of the classroom activity materials along with their English definitions. Because these words are derived directly from discipline-specific publications, utilizing GenAI "Gemini" to generate classroom activity materials based on a discipline-specific word list can allow students to concentrate on extremely restricted vocabulary. In addition, as EAP is widely considered a branch or sub-discipline of ESP, Ward's (2009) findings, which emphasize the value of specialist word lists in assisting ESP teachers with vocabulary setting, are also supported by this thesis. Metallurgical and Materials Science Engineering students and instructors may find this to be particularly significant in the conceptualization of the EAP course because there is a ubiquitous lack of graded word list studies in this field.

Table 11: Participants Performance

Participant ID	Pre-test Correct Answers Percentage (%)	Post-test Correct Answers Percentage (%)	Total Increase
1	35.5	54.0	18.5
2	30.0	36.5	6.5
3	30.5	51.0	20.5
4	20.0	26.5	6.5
5	35.0	43.0	8.0
6	47.0	53.5	6.5
7	35.5	48.0	12.5
8	40.0	49.5	9.5
9	31.5	37.0	5.5

Table 11 above presents the performance information of each participant before and after the GenAI-generated classroom activities. Based on the data, participant 9 exhibited the least improvement between the pre-test and post-test with a total increase of 5.5%, while participants 2, 4, and 6 exhibited an increase of 6.5%. Following these were participants 5 and 8, who saw an increase in accurate answers of 8.0% and 9.5%, respectively. Participant 7 ranked third among participants who benefited from GenAI-generated classroom activities, achieving a total gain of 12.5% in correct responses. Of the individuals who benefited from GenAI-generated classroom activities, with an increase of 18.5% in correct answers, participant 1 demonstrated the second-highest increase, while participant 3 demonstrated the largest increase with a total increase of 20.5% in correct answers. In conclusion, among the 9 participants, 5 participants demonstrated an increase falling between 1-10% correct answers, while 4 participants demonstrated an increase falling between 11-20% correct answers.

4.3. Pre-Test and Post-Test Analysis

A paired samples t-test and an analysis of the mean differences in the test results of the students were conducted to determine whether the incorporation of GenAI-generated classroom activities had an impact on the grasp of vocabulary of the students. After 3 weeks of implementation of GenAI-generated classroom activities, the same vocabulary test was implemented as a post-test. The two vocabulary tests' descriptive statistics are displayed in Table 12. The table illustrates that there are variances between the pre-test and post-test results. The quantity of data for each variable is indicated by the score of N. The score of N in the table in this thesis represents the total number of respondents—up to 9—who took part in the research sample. While the data's average score is displayed through the mean score (M) ($\mu = \Sigma X_i / N$). By adding the total score provided in the data and dividing the result by the sum of the total score, the mean score can be found. There was a difference between the pre-test and post-test mean scores. When compared to the post-test, the pre-test's mean score was lower. The pre-test mean score was M=33.88, while the post-test mean score was M=44.33. This demonstrates the descriptive variations in students learning results.

The degree to which the data deviates from the mean score is indicated by the standard deviation (SD) ($\text{sqrt}\ [\ \Sigma\ (X_i - \mu)^2 / (N - 1)]$). The more heterogeneous the data, the higher the standard deviation score, and vice versa. In the event that the standard deviation score exceeds the mean score, the mean score is a poor indicator of the entire data. On the other hand, the mean score is a good representation that may be utilized as a representation of full data if the standard deviation score is less than the mean score. According to the paired sample t-test results, the pre-test's standard deviation was 7.42 and the post-test's standard deviation was 9.33, indicating that both tests' standard deviations were below the mean. As a result, the pre-test and post-test averages can accurately reflect the total data.

Table 12: Descriptive Statistics of Vocabulary Test Scores

	N	Minimum	Maximum	Mean	Std. Error	Std. Deviation
Pre-Test	9	20,00	47,00	33,8889	2,47456	7,42369
Post-Test	9	26,50	54,00	44,3333	3,11136	9,33408

Table 13 illustrates the results of the paired samples t-test. The average score of the pairwise differences obtained from the variation in the mean scores was the average score shown in Table 13. According to the test findings, the difference's average score was -10,444. The standard deviation at Table 13 is the pairwise differences' sample standard deviation. The test findings indicate that the difference's standard deviation was 5,570. The calculation of the standard deviation of the sample mean distribution for a population of infinite size is referred to as the standard error mean (SEM) (Lee et al., 2015). The findings indicate that the average test result's standard error value was 1.856. The confidence range of the confidence interval for the mean difference is the upper and lower confidence range.

The t value that is utilized to construct confidence ranges is the one found in Table 13. It is determined by the degree of confidence and freedom. Conversely, the degree of freedom, or df, is the degree of freedom that is utilized to ascertain the distribution of T from which t is created. A comparison between the t statistic and the t table can be used to make a judgment if the values of t and df are known. H_0 is rejected (no significant difference) and H_1 is accepted (there is a significant difference), and vice versa, if the t-statistical value is higher than the t-table value. It was determined that the test findings' statistical t value was 5.625. The t distribution table, which has a value of df equal to 9, indicates that the t table value is 2.262. This indicates that the vocabulary scores of students studying Metallurgical and Materials Science Engineering are significantly impacted by the utilization of educational materials generated by GenAI "Gemini".

The significant score, or p-score, in Table 13 can also be used to establish significance in addition to the t-value. In order to reject the hypothesis that there is no relationship between two paired groups (H_0) and accept the hypothesis that there is a relationship between two paired groups (H_1), the rationale indicates that the significance (Sig. 2-tailed) must be less than 0.05. H_0 was rejected while H_1 was accepted based on the paired samples t-test findings, which revealed a significance (Sig. 2-tailed) of 0.0004. Thus, the use of educational materials produced by GenAI "Gemini" has a considerable impact on the vocabulary scores of students studying Metallurgical and Materials Science Engineering.

In conclusion, a difference of statistical significance between the mean vocabulary test scores of the pre-test (M=33.88, SD=7.42) and post-test (M=44.33, SD=9.33) was found using the paired-samples t-test, as detailed in Table 12 below. The post-test was favored with $t(8) = -5.625$, $p < .001$ (2-tailed).

Table 13: Paired Samples T-test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Pre-Test - Post-Test	-10,44444	5,57026	1,85675	-14,72612	-6,16276	-5,625	8	0.0004

4.4. Discussion

Over several decades, the discussions surrounding the relationship between vocabulary and learners' performance in English language skills have emerged as a significant topic within applied linguistics. This thesis examines the connection between the English language vocabulary skills of Metallurgical and Materials Science Engineering learners and discipline-specific technical word lists. The main objectives of this thesis were to create classroom activities utilizing generative AI, evaluate the efficacy of the AI-generated instructional materials, and create technical word lists for four subfields of Metallurgical and Materials Science Engineering for EAP students interested in a career in this field. The findings indicate that the results mainly aligned with the study's expectations, as participants demonstrated an improvement in vocabulary skills attributed to the discipline-specific word list developed by the researcher and the AI-generated classroom activities centered around this word list. In addition, the findings of this thesis support previous research that looked at the function of AWLs in scholarly literature.

The following research questions were asked in the thesis.

RQ.1. Which discipline-specific words occur most frequently in the Meta-MatCorp, corpus of Metallurgical and Materials Science Engineering?

AWLs developed with the utilization of corpus tools are essential for students and researchers who aspire to pursue studies in the broad subject of Metallurgical and Materials Science Engineering, which is an extensive field in terms of engineering. In order to develop word lists for each subfield of Metallurgical and Materials Science Engineering, the 200 most frequently occurring words for each list in journal articles indexed by SCI were chosen. Following that, these words were compiled to develop the following word lists: CMWL, MSWL, MWL, and PSTWL. During the process of creating these word lists, the researcher discovered that certain words were shared by all of them. Once the words that were common throughout all word lists were identified, a “Common Words List” was created.

Prior to compiling these word lists, the target database was examined utilizing the corpus analysis application AntWordProfiler. The analysis discovered words that might be classified as technical vocabulary but were not included in either GSL or AWL sub-lists. For each word list, the researcher first selected the top 800 words after trimming the entire list to a shorter length. The GenAI "Gemini" was utilized to develop final word lists by uploading each word list and three discipline-specific dictionaries. Subsequently, the researcher prompted GenAI "Gemini" to identify words that were listed in discipline-specific dictionaries by comparing word lists with those dictionaries. The researcher removed words that were absent from the three discipline-specific dictionaries—the ASM Materials Engineering Dictionary by Joseph R. Davis (1992), the Dictionary of Metallurgy by Colin D. Brown (1998), and MetalBilim ve GerecBilim by Erdoğan Tekin (2006)—after manually reviewing the word lists generated by GenAI "Gemini". According to Trimble (1985), terminology used in academia may have broad definitions in technical contexts and may signify entirely distinct things in other fields. It is also crucial to keep in mind that an array of words from CMWL, MSWL, MWL, and PSTWL that appear to be commonly utilized in academic or general service vocabulary might in fact have distinct definitions and usage patterns when employed in scientific writings.

Table 14: Coxhead's AWL Coverage Results

Corpora/Studies	Year	AWL Coverage Results
Ceramic Materials sub-corpus	2025	9,47%
Materials Science sub-corpus	2025	10,04%
Metallurgy sub-corpus	2025	9,70%
Polymer Science and Technology sub-corpus	2025	10,51%
Cheng & Ge	2007	10,07%
Li & Qian	2015	10,46%
Vangpumivitch et al	2009	11,17%
Zhang	2013	10,39%
Cobb & Horst	2004	6.72%

Furthermore, from the results, it was reasonable to conclude that Coxhead's AWL coverage in this thesis was comparable to that of earlier inquiries (e.g., Cheng & Ge, 2007; Li & Qian, 2015; Vangpumivitch et al., 2009; Zhang, 2013). In comparison to this thesis' Coxhead's AWL coverage results, which were 9.47% for the Ceramic Materials sub-corpus, 10.04% for the Materials Science sub-corpus, 9.70% for the Metallurgy sub-corpus, and 10.51% for the Polymer Science and Technology sub-corpus, the previous studies Coxhead's AWL coverage results were 10.07% (Cheng & Ge, 2007), 10.46% (Li & Qian, 2015), 11.17% (Vangpumivitch et al., 2009), and 10.39% (Zhang, 2013). These results lend credence to earlier studies that examined the role of AWL in academic texts. The Coxhead's AWL statistics from this thesis, however, were comparatively greater than the Cobb and Horst (2004) study's AWL coverage of 6.72%.

RQ.2 How do the widely used word lists—the NGSL, and the NAWL—relate to discipline-specific technical word lists derived from corpora of scholarly articles published in SCI-indexed journals?

This research question aims to examine the correlation between the word lists created in this thesis and two prominent word lists utilized in language teaching: the NGSL (Browne et al., 2013a) and the NAWL (Browne et al., 2013b), with the objective of assessing the degree of their overlap. The NGSL and the NAWL are regarded as revised and superior iterations of West's (1953) GSL and Coxhead's (2000) AWL. The NGSL (Browne et al., 2013a) comprises 2,809 terms that appear with considerable frequency in general English usage. The NGSL is derived from a meticulously curated academic corpus of 273 million words, providing roughly 92% coverage of the majority of texts. On the other hand, the NAWL (Browne et al., 2013b), comprises around 960 words that are highly prevalent in mainstream academic English. The NAWL is derived from a meticulously curated academic corpus of 288 million words and provides roughly 92% coverage of the majority of academic publications when studied alongside the 2800 core general English terms in the NGSL. With the justification that each list addressed a distinct field—for example, the NAWL covers the academic field, while the NGSL, as their name implies, focus on English for general purposes—these two word lists were selected for comparison.

Figure 4: Word List Comparison

Coverage of	CMWL	MSWL	MWL	PSTWL
NGSL	6.67%	10.97%	6.25%	7.84%
NAWL	17.33%	20.25%	16.83%	15.29%

The comparison was carried out utilizing AntwordProfiler. As illustrated in Figure 4, the most commonly used words in the English language, the NGSL, contained 6.67% of the 200 words of the CMWL, 10.97% of the 200 words of the MSWL, 6.25% of the 200 words of the MWL, and 7.84% of the 200 words of the PSTWL. The NAWL, on the other hand, consisted of 17.33% of the 200 words in the CMWL, 20.25% of the 200 words in the MSWL, 16.83% of the 200 words in the MWL, and 15.29% of the 200 words in the PSTWL.

Figure 5: Total Coverage of the NGSL and NAWL

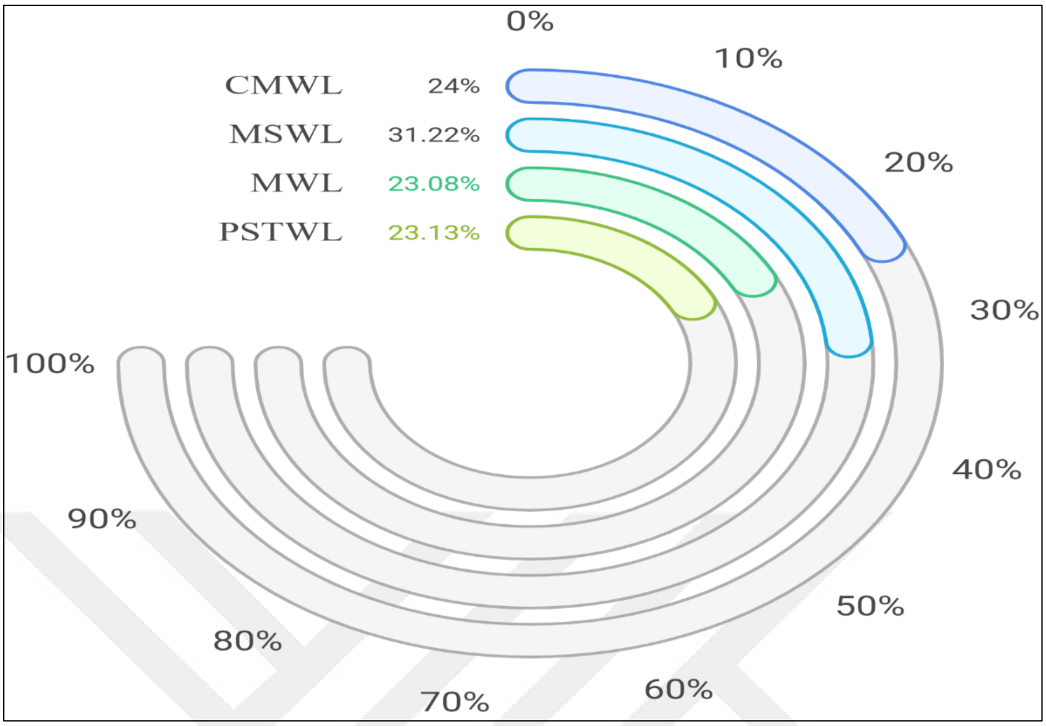


Figure 5 depicts the total coverage of the NGSL and NAWL of the word lists driven from Meta-Matcorp sub-corpora. These two word lists cover 24% of the CMWL, 31.22% of the MSWL, 23.08% of the MWL, and 23.13% of the PSTWL. A certain percentage of the words in the word lists derived from sub-corpora of Meta-Matcorp were general service words and words that were commonly used in the academic field, as indicated by these data. The findings of Martinez and his colleagues' work on detecting field-specific language through specialized corpora (Martinez et al., 2009) were consistent with this outcome. According to their research, just 92 word families from Coxhead's AWL were included in the 826,416-word AgroCorpus, a specialized corpus they assembled for the discipline of agriculture.

The requirement for discipline-specific technical word lists unique to the field being studied was further supported by this comparison. The third-year Metallurgical and Materials Engineering courses seem to have a particular lexicon that should guide the development of English education. Hyland and Tse (2007) emphasize the significance of word lists like GSL and AWL, though they argue that their flaw is the presumption that a single database can accurately reflect the vocabulary of all academic discourses and, as a result, be helpful to all students, regardless of their field of study. According to their research, the coverage of AWL is not uniformly distributed throughout the corpus, indicating that words can have distinct meanings in different disciplines and that some things are more common in particular fields. In a similar vein, the findings of this thesis support the necessity of word lists that include the discipline-specific language of the particular field being studied and from which the particular learner group might profit.

RQ.3 What is the impact of the instructional materials created by GenAI for students studying Metallurgical and Materials Science Engineering on their vocabulary scores?

The terminology highlighting the content of the classroom materials has to be specified in order to identify what the students must learn in order to further their academic careers in this field. With four sub-corpuses, Meta-Matcorp was created from scholarly articles published in SCI-indexed journals in an effort to define the lexical content that students require to be exposed to. Koester (2010) asserts that specialized corpora offer valuable insights into the individual genres under investigation, including highly specialized forms of academic or scientific writing.

The selected Meta-Matcorp sub-corpus "Metallurgy" for this thesis has 451,564 words, while the Meta-Matcorp as a whole consists of 1,788,459 words. Although there are benefits to using large corpora, depending on the intended usage, small corpora may also be beneficial. Large corpora, according to Trible (2002), do not meet the goals of ESP/EAP teachers and students because they either provide an excessive amount of information on an overly broad spectrum or provide insufficient targeted data to be directly beneficial to students with particular learning objectives.

GenAI "Gemini" developed the classroom activities based on the MWL, which was derived from the "Metallurgy" sub-corpus of Meta-Matcorp. Over the course of three weeks, five different activity categories were included in the GenAI-generated classroom activity materials. The classroom activities encompassed fill-in-the-blanks, word matching, true or false, multiple choice, and translation exercises. Since MWL words were derived straight from discipline-specific articles that were published in SCI-indexed journals, utilizing GenAI "Gemini" to generate instructional materials based on MWL offered students the opportunity to focus on a very limited vocabulary, thus enhancing their discipline-specific vocabulary.

There were 9 out of the 37 participants who took both the pre-test and post-test. The efficiency of the GenAI-generated classroom activity materials in teaching discipline-specific vocabulary was further demonstrated by an analysis of the total correct answer percentage increase of every participant and a paired-sample t-test. Of the 9 participants, 5 exhibited an increase of 1-10% in correct answers, whereas 4 displayed an increase of 11-20% in correct answers. Among the 9 people who participated, the least improvement in correct answers was 5.5%, while the most substantial improvement was 20.5%. On the other hand, the paired sample t-test exhibited a statistically significant distinction between the pre-test and post-test analysis. With $t(8) = -5.625$, $p < .001$ (2-tailed), the post-test was preferred as a result of the paired samples t-test, which strongly suggests that the intervention that occurred between the pre-test and the post-test had a significant effect. There was a statistically significant difference between the pre-test and post-test results, with the latter being 10.44 points higher on average. In addition, the null hypothesis (H_0) was rejected since the p-value (0.0004) was significantly smaller than the conventional significance level ($\alpha=0.05$), while the alternative hypothesis (H_1), which states that there is a significant difference between the mean pre-test and post-test scores, was accepted.

Comparing the results of the pre-test and post-test demonstrated that GenAI-generated classroom activities assisted students in learning discipline-specific vocabulary, validating the potential usefulness of discipline-specific technical word lists for acquiring new vocabulary (Liu and Han, 2015). It further illustrated the effectiveness of small-scale corpora as opposed to creating extensive lists of words that are not discipline-specific (Ward, 2009). Furthermore, this thesis' findings support Nation (2016)'s assertion that word lists can be utilized to assist with the creation of courses.

CONCLUSIONS AND RECOMMENDATIONS

Summary of the Thesis

For students studying Metallurgical and Materials Science Engineering, this study attempted to define the most common technical terms found in journal papers indexed by SCI. Specialized vocabulary necessitates a strategic approach that emphasizes the selection of the words to learn and the method of learning them (Coxhead, 2016; Nation, 2013). Therefore, creating such word lists was an efficient method to develop GenAI-generated classroom activity materials for the third-year Metallurgical and Materials Engineering Department students at Karadeniz Technical University. The creation of isolated word lists was an attempt to discover a solution to what to provide students with in a particular setting.

In an effort to create word lists—800–200 words for each word list—the most prevalent words identified in journal articles indexed by SCI were selected. These words were then used to compile the CMWL, MSWL, MWL, and PSTWL. AntWordProfiler, a corpus analysis tool, was utilized to analyze the target database before the word lists were compiled. The words that may be considered technical vocabulary yet were not included in any GSL or AWL sub-lists were identified by the analysis. Each word list's top 800 most frequent words were then chosen for the study and uploaded to GenAI "Gemini" with three distinct technical dictionaries. GenAI "Gemini" was then prompted by the researcher to compare word lists with discipline-specific dictionaries in order to identify the words that were listed in those dictionaries. After manually checking the GenAI "Gemini" generated word lists, the researcher removed words that were not listed in the three discipline-specific dictionaries. The word lists compiled in this study were verified with two experts to create the final word lists. The final lists, which each had 200 words, were CMWL, MSWL, MWL, and PSTWL. The comparison between commonly utilized word lists and discipline-specific technical word lists extracted from corpora of scholarly articles published in SCI-indexed journals revealed that a specific percentage of the terms in the word lists derived from sub-corpora of Meta-Matcorp consisted of general service words and terms frequently employed in the field of academia. The classroom activity materials were created by GenAI "Gemini" based on the MWL. The GenAI-generated classroom activity materials comprised five distinct activity categories, and they were implemented for three weeks. The paired-samples t-test revealed a statistically significant distinction, with $p < .001$, from the pre-test and post-test analysis, further demonstrating the effectiveness of the GenAI-generated classroom activity materials in teaching discipline-specific terminology. By endorsing the concept of discipline-specific vocabulary lists, this thesis' findings also validated earlier research (e.g., Hyland & Tse, 2007).

Implications

The significant nature of discipline-specific word lists was rendered clear by the thesis's data analysis. By compiling these lists from scholarly publications and consulting with professionals, it is ensured that students are acquiring the most frequently utilized terms in their discipline. Furthermore, this thesis illustrates that teaching discipline-specific vocabulary may be accomplished quite successfully by utilizing GenAI "Gemini" to produce pertinent learning resources. According to the findings of the thesis, employing the GenAI-generated activities improved students' test scores in a statistically meaningful manner. This implies that this approach remains not only practical but also an effective way to aid students in disciplines such as materials engineering and metallurgical engineering in understanding discipline-specific jargon.

Suggestions and Further Research

Discipline-specific technical word lists and GenAI-generated classroom exercises for third-year students in the Metallurgical and Materials Science Engineering Department were the sole goals of the quasi-experimental design. This extensive thesis is the result of the enormous quantity of texts that are available to create a database. Nevertheless, additional research can be conducted by examining the following different aspects:

- In this thesis, only four subfields of the Engineering Department of Metallurgical and Materials Science were covered. Better results and variations in technical terminology to be included in discipline-specific word lists can be obtained from a database that compiles all five of the Metallurgical and Materials Science Engineering fields.
- The content that the GenAI "Gemini" generated was designed to teach just one of the word lists. Further study of the course material is feasible, and all word lists—not just one—can be incorporated. Individual words and a few collocations were also covered in this study; nonetheless, as collocations might be significant, a corpus-based investigation can also be employed to discover all collocational patterns.
- Since only receptive vocabulary knowledge was assessed, more research in the field of Metallurgical and Materials Science engineering can be conducted that focuses on productive vocabulary knowledge or the connection between vocabulary knowledge and reading comprehension.
- Since only third-year students without any prior exposure to discipline-specific technical vocabulary instruction were included in this thesis, additional research in the field that

focuses on students with diverse language skills and vocabulary needs may also assist in better course design.

REFERENCES

Akbarian, Is'haaq (2010), "The relationship between vocabulary size and depth for ESP/EAP learners", **System**, 38, 391-401.

Anthony, Laurence (2024), "AntWordProfiler (Version 2.2.1) [Computer Software]", https://www.laurenceanthony.net/software/AntWordProfiler (10.02.2025).

Asadova, Birgül (2024), "The Role of Collocations in English Language Teaching", **Acta Globalis Humanitatis et Linguarum**, 1(2), 9-19.

Brown, Colin D. (1998), **Dictionary of Metallurgy**, 1st Ed., John Wiley & Sons, West Sussex.

Browne, Charles et al. (2013a), **New General Service List 1.2**, https://www.newgeneralservicelist.com/new-general-service-list (10.02.2025).

______________________________ (2013b), **New Academic Word List 1.20**, https://www.newgeneralservicelist.com/new-general-service-list-1 (10.02.2025).

Charles, Maggie (2013), "English for Academic Purposes", **The Handbook of English for Specific Purposes,** 1st Edition *inside* (137-154), John Wiley & Sons, West Sussex.

Chen, Qi and Ge, Guang-chun (2007), "A corpus-based lexical study on frequency and distribution of Coxhead's AWL word families in medical research articles (RAs)", **English for Specific Purposes**, 26, 502-514.

Chung, Teresa Mihwa and Nation, Paul (2003), "Technical vocabulary in specialized texts", **Reading in a Foreign Language**, 15(2), 103-116.

______________________________________ (2004), "Identifying technical vocabulary", **System**, 32(2), 251-263.

Cobb, Tom and Horst, Marlise (2004), "Is there room for an academic word list in French?", **Vocabulary in a second language**, Editions *inside* (15-38), John Benjamins Publishing Company, Amsterdam.

Cotton, Debby et al. (2024), "Chatting and cheating: Ensuring academic integrity in the era of ChatGPT", **Innovations in Education and Teaching International**, 61(2), 228-239.

Coxhead, Averil (2000), "A new academic word list", **TESOL Quarterly**, 34(2), 213-238.

______________ (2011), "The academic word list 10 years on: research and teaching implications", **TESOL Quarterly**, 45(2), 355-362

_____________ (2013), "Vocabulary and ESP", **The Handbook of English for Specific Purposes,** 1st Edition *inside* (115-132), John Wiley & Sons, West Sussex.

_____________ (2016), "Acquiring Academic and Disciplinary Vocabulary", **The Routledge Handbook of English for Academic Purposes**, 1st Edition *inside* (177-190), Routledge, New York.

_____________ (2020), "Academic vocabulary", **The Routledge Handbook of Vocabulary Studies,** 1st edition *inside* (97-110), Routledge, New York.

Coxhead, Averil and Nation, Paul (2001), "The specialised vocabulary of English for academic purposes", **Research Perspectives on English for Academic Purposes**, 1st edition *inside* (252-267), Cambridge University Press, Cambridge.

Coxhead, Averil et al. (2017), "Single and multi-word unit vocabulary in university tutorials and laboratories: Evidence from corpora and textbooks", **Journal of English for Academic Purposes,** 30, 66-78.

Darvishi, Ali et al. (2024), "Impact of AI assistance on student agency", **Computers and Education**, 210, 1-18.

Davis, Joseph R (1992), **ASM Materials Engineering Dictionary**, 1st Ed., ASM International, Ohio.

Demir, Cüneyt (2018), "Word combinations of English in academic writing", **Journal of Language and Linguistic Studies**, 14(1), 293-327.

Erdoğan, Tekin (2006), **Metalbilim Ve Gereçbilim Karşılıklar Sözlüğü**, 2nd Ed., Erdemir Bilim ve Teknoloji Serisi, Ankara.

Heatley, Alex et al. (2004), "RANGE (Version 3.1) [Computer Software]", https://www.wgtn.ac.nz/lals/resources/paul-nations-resources/vocabulary-analysis-programs (05.03.2025).

Hu, Marcella and Nation, Paul (2000), "Unknown vocabulary density and reading comprehension", **Reading in a Foreign Language**, 13(1), 403-430.

Hunston, Susan (2002), **Corpora in Applied Linguistics**, Cambridge University Press, Cambridge.

Hyland, Ken and Hamp-Lyons, Liz (2002), "EAP: issues and directions", **Journal of English for Academic Purposes**, 1, 1-12.

Hyland, Ken and Tse, Polly (2007), "Is there an "academic vocabulary"?", **TESOL Quarterly**, 41(2), 235-253.

Jackson, Sherry (2011), **Research methods and statistics: a critical thinking approach**, 3rd Ed., Wadsworth Cengage Learning, California.

Khodabakhshi, Saloumeh et al. (2014), “Vocabulary Knowledge Assessment of Iranian EAP Undergraduate Students”, **Procedia – Social and Behavioral Sciences**, 98, 950-958.

Koester, Almut (2010), **Workplace Discourse**, 1st Ed., Bloomsbury Publishing, New York.

Kohnke, Lucas et al. (2023), “ChatGPT for Language Teaching and Learning”, **RELC Journal**, 54(2), 537-550.

Kwary, Deny Arnos (2011), “A hybrid method for determining technical vocabulary”, **System**, 39(2), 175-185.

Lee, Dong Kyu et al. (2015), “Standard deviation and standard error of the mean”, **Korean Journal of Anesthesiology**, 68(3), 220-223.

Li, Yongyan and Qian, David (2010), “Profiling the Academic Word List (AWL) in a financial corpus”, **System**, 38, 402-411.

Liu, Dilin and Lei, Lei (2020), “Technical Vocabulary”, **The Routledge Handbook of Vocabulary Studies**, 1st edition *inside* (111-124), Routledge, New York.

Liu, Jia and Hun, Lina (2015), “A corpus-based environmental academic word list building and validity test”, **English for Specific Purposes**, 30, 1-11.

Lu, Cailing and Dang, Thi Ngoc Yen (2022), “Vocabulary in EAP learning materials: What can we learn from teachers, learners, and corpora?”, **System**, 106, 102791.

Martinez, Iliana et al. (2009), “Academic vocabulary in agriculture research articles: A corpus- based study”, **English for Specific Purposes**, 28, 183-198.

Miller, Don (2012), “The challenge of constructing a reliable word list: an exploratory corpus- based analysis of introductory psychology textbooks**”, Corpus-based Research in Applied Linguistics: Studies in honor of Doug Biber**, 1st edition *inside* (227-242), Wiley Blackwell, West Sussex.

Mudraya, Olga (2006), “Engineering English: A lexical frequency instruction profile”, **ESP Journal**, 25(2), 235-256.

Nation, Paul and Waring, Rober (1997), “Vocabulary size, text coverage, and word lists”, **Vocabulary: Description, Acquisition and Pedagogy**, 1st edition *inside* (6-19), Cambridge University Press, Cambridge.

Nation, Paul (2008), **Teaching Vocabulary: Strategies and Techniques**, Heinle ELT, Boston.

__________ (2013), **Learning Vocabulary in Another Language**, 2nd Ed., Cambridge University Press, Cambridge.

__________ (2016), **Making and using word lists for language learning and testing**, John Benjamins, Amsterdam.

Özer, Mustafa and Akbaş, Erdem (2024), "Assembling a justified list of academic words in veterinary medicine: The veterinary medicine academic word list (VMAWL)", **English for Specific Purposes**, 74, 29-43.

Scott, David and Usher, Robin (2011), **Researching Education Data, Methods and Theory in Educational Enquiry**, 2nd Ed., Continuum International Publishing Group, New York.

Skoufaki, Sophia and Petric, Bojana (2021), "Academic vocabulary in an EAP course: Opportunities for incidental learning from printed teaching materials developed in-house", **English for Specific Purposes**, 63, 71-85.

Trible, Cristopher (2002), "Corpora and corpus analysis: New windows on academic writing", John Flowerdew (Ed), **Academic Discourse**, in (131-149), Routledge, London.

Trimble, Louis (1985), **English for science and technology: A discourse approach**, 1st Ed., Cambridge University Press, Avon.

Ulla Mark Bedoya et al., "How can GenAI foster an inclusive language classroom? A critical language pedagogy perspective from Philippine university teachers", **Computers and Education: Artificial Intelligence**, 7, 1-8.

van Niekerk, Johan et al. (2025), "Addressing the use of generative AI in academic writing", **Computers and Education: Artificial Intelligence**, 8, 1-11.

Valipouri, Leila and Nassaji, Hossein (2013), "A corpus-based study of academic vocabulary in chemistry research articles", **Journal of English for Academic Purposes**, 12, 248-263.

Vongpumivitch, Viphavee et al. (2009), "Frequency analysis of the words in the Academic Word List (AWL) and non-AWL content words in applied linguistics research papers", **English for Specific Purposes**, 28, 33-41.

Wang, Jing et al. (2008), "Establishment of a medical word list", **English for Specific Purposes**, 27, 442-458.

_____________ (2024), "ChatGPT's capabilities in providing feedback on undergraduate students' argumentation: A case study", **Thinking Skills and Creativity**, 51, 1-14

Ward, Jeremy (2009), "A basic engineering English word list for less proficient foundation engineering undergraduates", **English for Specific Purposes**, 28, 170-182.

West, Michael, (Ed.) (1953), **A general service list of English words,** Longman, London.

Woodward-Kron, Robyn (2008), "More than just jargon – the nature and role of specialist language in learning disciplinary knowledge", **Journal of English for Academic Purposes**, 7(4), 234-249.

Yang, Ming-Nuan (2015), "A nursing academic word list. English for Specific Purposes", **English for Specific Purposes**, 37, 27-38.

Zhang, Min (2013), “A corpus-based comparative study of semi-technical and technical vocabulary”, **The Asian ESP Journal**, 9 (2), 148-172.

Xue, Guo-yi and Nation, Paul (1984), “A University Word List”, **Language Learning and Communication**, 3(2), 215-229.

APPENDIXES

Appendix 1: Research Ethics Committee Approval

17.01.2025 08:16
E-26014373-050.06.04-608753
05072331

HİZMETE ÖZEL

T.C.
KARADENİZ TEKNİK ÜNİVERSİTESİ REKTÖRLÜĞÜ
Sosyal ve Beşeri Bilimler Etik Kurulu

Sayı : E-26014373-050.06.04-608753 17.01.2025
Konu : Etik Kurul Kararı (Bera Taragay KARAOĞLU)

REKTÖRLÜK MAKAMINA
(Hukuk Müşavirliği)

İlgi : 26.12.2024 tarihli ve E-90783813-010.99-17114 sayılı yazı.

KTÜ – Sosyal Bilimler Enstitüsü Batı Dilleri ve Edebiyatı Anabilim Dalı öğretim üyesi Doç. Dr. Ali Şükrü ÖZBAY'ın akademik danışmanlığında, Uygulamalı Dil Bilimi Tezli Yüksek Lisans Programı öğrencisi 424525 numaralı Bera Taragay KARAOĞLU'nun yürüttüğü **"The Development of Corpus-Based Genre-Specific Terminology and the Self-Study Materials for EAP Teaching: The Case of Metallurgical and Materials Engineering)"** başlıklı yüksek lisans tezi kapsamında "Etik Kurul Belgesi" ile ilgili olarak kurulumuza yaptığı başvuru değerlendirilerek uygun bulunmuş ve sonucu Ek'te gönderilmiştir.

İlgili öğrencinin bilgilendirilmesi hususunda gereğini arz ederim.

Prof. Dr. Abdülkadir PEHLİVAN
Başkan

Ek: Toplantı Tutanağı (3 Sayfa)

Bu belge güvenli elektronik imza ile imzalanmıştır.
Doğrulama Kod: 3101AA3F-2173-48EB-8889-A2401EC8D70B HİZMETE ÖZEL Doğrulama Adres: https://www.turkiye.gov.tr/karadeniz-teknik-universitesi-ebys

61080 – Trabzon / TÜRKİYE
Tel: 0(462)3772116 Faks: 0(462)3253205 www.ktu.edu.tr
Ayrıntılı Bilgi İçin İrtibat Elif EROL GÖKÇE genelsekreterlik@ktu.edu.tr
Sayfa 1 / 1

Appendix 1: (Continued)

20.01.2025 17:56
E-82554930-050.01.04-610033
05077872

HİZMETE ÖZEL

KTÜ 1955

T.C.
KARADENİZ TEKNİK ÜNİVERSİTESİ REKTÖRLÜĞÜ
Hukuk Müşavirliği

Sayı : E-82554930-050.01.04-610033 — 20.01.2025
Konu : Etik Kurul Kararı (Bera Taragay KARAOĞLU)

Sn. Bera Taragay KARAOĞLU

İlgi : 17.01.2025 tarihli ve E-26014373-050.06.04-608753 sayılı yazı.

KTÜ-Sosyal Bilimler Enstitüsü Batı Dilleri ve Edebiyatı Anabilim Dalı Uygulamalı Dil Bilimi Tezli Yüksek Lisans Programı öğrencisi Bera Taragay KARAOĞLU'nun **"The Development of Corpus-Based Genre-Specific Terminology and the Self-Study Materials for EAP Teaching: The Case of Metallurgical and Materials Engineering"**adlı yüksek lisans tezi kapsamında çalışma için gerekli olan Etik Kurul incelemesi yapılmış ve başvurunuza onay verilmiştir.

Bilgilerinize ve gereğini rica ederim.

Prof. Dr. Ali TEMİZ
Rektör Yardımcısı

Bu belge güvenli elektronik imza ile imzalanmıştır.

Doğrulama Kod: 40106C31-154E-4924-9DA5-34D74297EE13 HİZMETE ÖZEL Doğrulama Adres: https://www.turkiye.gov.tr/karadeniz-teknik-universitesi-ebys

61080 – Trabzon / TÜRKİYE
Tel: 04623772107 Faks: 04623774399 www.ktu.edu.tr
Ayrıntılı Bilgi İçin İrtibat Belgin ŞEN hukukmusavirligi@ktu.edu.tr
Sayfa 1 / 1

Appendix 2: Volunteer Participant Form

ARAŞTIRMA GÖNÜLLÜ KATILIM FORMU

Bu çalışma, Akademik Amaçlı İngilizce Öğretiminde, alan bazlı özel terminolojinin ve çalışma materyallerinin derlem odaklı belirlenmesi ve geliştirilmesi: Metalürji ve Malzeme Mühendisliği Örneği başlıklı bir araştırma çalışması olup, bu alanda kullanılan en sık kelime, fiil ve sıfatların bulunup çalışma materyali haline getirilmesini amaçlamaktadır. Çalışma, Bera Taragay Karaoğlu tarafından yürütülmekte ve sonuçları ile Metalürji ve Malzeme Mühendisliği öğrencilerinin gelişimine ışık tutması beklenmektedir.

- Bu çalışmaya katılımınız gönüllülük esasına dayanmaktadır.
- Çalışmanın amacı doğrultusunda, elden dağıtılan worksheetler aracılığıyla sizden veriler toplanacaktır.
- İsminizi yazmak ya da kimliğinizi açığa çıkaracak bir bilgi vermek zorunda değilsiniz/araştırmada katılımcıların isimleri gizli tutulacaktır.
- Araştırma kapsamında toplanan veriler, sadece bilimsel amaçlar doğrultusunda kullanılacak, araştırmanın amacı dışında ya da bir başka araştırmada kullanılmayacak ve gerekmesi halinde, sizin (yazılı) izniniz olmadan başkalarıyla paylaşılmayacaktır.
- İstemeniz halinde sizden toplanan verileri inceleme hakkınız bulunmaktadır.
- Sizden toplanan veriler belge-dosya şifreleme yöntemi ile korunacak ve araştırma bitiminde arşivlenecek veya imha edilecektir.
- Veri toplama sürecinde/süreçlerinde size rahatsızlık verebilecek herhangi bir soru/talep olmayacaktır. Yine de katılımınız sırasında herhangi bir sebepten rahatsızlık hissederseniz çalışmadan istediğiniz zamanda ayrılabileceksiniz. Çalışmadan ayrılmanız durumunda sizden toplanan veriler çalışmadan çıkarılacak ve imha edilecektir.

Gönüllü katılım formunu okumak ve değerlendirmek üzere ayırdığınız zaman için teşekkür ederim. Çalışma hakkındaki sorularınızı Karadeniz Teknik Üniversitesi Uygulamalı Dilbilim bölümünden Bera Taragay Karaoğlu'na yöneltebilirsiniz.

Araştırmacı Adı : Bera Taragay KARAOĞLU
Adres : Karadeniz Teknik Üniversitesi Batı Dilleri ve Edebiyatı Bölümü Cep Tel: (+90) 545 340 85 68

Bu çalışmaya tamamen kendi rızamla, istediğim takdirde çalışmadan ayrılabileceğimi bilerek verdiğim bilgilerin bilimsel amaçlarla kullanılmasını kabul ediyorum.
(Lütfen bu formu doldurup imzaladıktan sonra veri toplayan kişiye veriniz.)

Katılımcı Ad ve Soyadı:
İmza:

Appendix 3: Pre-Test

Pre-test
Metallurgy and Materials Engineering

Name - Surname =

Please write the Turkish definitions of the vocabulary items given in English below. (Please leave the definitions for the vocabulary items you do not know empty). Lütfen aşağıda İngilizcesi verilen kelimelerin Türkçe karşılıklarını yanlarına yazınız. Bilmediğiniz kelimeleri boş bırakınız.

Alloy =
Leaching =
Sintering =
Density =
Matrix =
Carbon =
Microstructure =
Composite (material) =
Acid =
Deformation =
Fracture =
Metallurgy =
Slag =
Strain =
Voidage =
MPa =
pH (value) =
Oxygen =
Ore =
Titanium =
Interface =
Furnace =
Corrosion =
Fatigue =
Coating =
Oxide =
Hydrogen =
Diffusion =
Pore/Porosity =
Electron =
Magnetic =
Dislocation =
Vacuum =
Coke =
Feed =
Ion =
Morphology =
Microhardness =
Nickel =
Dissolution =
Matte =
Laser =
Coefficient =
Precipitate =

Zinc =
Brittle =
Compact =
Calcium =
Dislocation =
Smelting =
Oxidation =
Residuals/Residual elements =
Plastics (materials) =
Hematite =
Adsorption =
Manganese =
Recrystallization =
Friction =
Diffraction =
Magnesium=
Ductility =
Stainless (steel/iron) =
Shear =
Carbide =
Crystal =
Cast =
Microscope =
Ceramic =
Braze =
Phosphorus =
Elongation =
Concentration =
Austenite =
Equilibrium =
Silicon =
Atom =
Weld =
Silica =
Martensite =
Calcite =
Voidage =
Microscopy =
Tungsten =
Alkali =
Vanadium =
Solidification =
Eutectic / Eutectoid =

Chromium =
Densification =
Magnetite =
Machinability =
Lattice =
Cell =
Conductivity =
Quartz =
Electrolyte =
Tailings =
Propagation =
Anode =
Nucleation =
Sodium =
Clad, cladding =
Vickers (hardness) test =
Drill =
Lithium =
Defect =
Alumina =
Electrode (welding) =
Nitrogen =
Equiaxed =
Spinel =
Liquidus =
Ingot =
Flux =
Texture =
Lime =
Graphite =
Ferrite =
Scrap =
Ultrasonic =
Situ (In situ) =
Galena =
Forging =
Evaporation =
Arc =
Uniaxial =
Plasma =
Zircon =
Superalloys =
Sulphur =
Fusion =

Appendix 3: (Continued)

FCC =
Dimples/ing =
Coarsening =
Substrate =
Crucible =
AC =
Granulation =
Chip =
Boron =
Aqueous =
Wrought =
Blasting =
Spectrometer =
Aluminium =
Facet =
Potassium =
Ligament =
ISO =
Fluid =
Cleavage =
Activated =
Mesh =
Crystalline =
Battery =

Filler =
Converter =
Germanium =
Segregation =
ASTM =
HAZ (Heat affected zone) =
Susceptibility =
Quench =
Abrasion, abrasive wear =
Pyrites =
Lubricant =
Absorption =
Twin =
Solvent =
Limestone =
Cathode =
Build-up =
Refractory =
Penetration =
Methane =
Macro =
Lamellae =
Filtration =

Slurry =
Acicular =
Magnification =
Argon =
Stud =
Thermodynamics =
Preheating =
Solute =
Silicate =
Resistivity =
Flakes =
Shrinkage =
Isostatic =
Fluorescence =
Electrowinning =
Binary =
Bellows =
Annealing =
Anion =
Sigma (phase) =
Plasticity =
Mullite=

Appendix 4: Post-Test

Post-test
Metallurgy and Materials Engineering

Name - Surname =

Please write the Turkish definitions of the vocabulary items given in English below. (Please leave the definitions for the vocabulary items you do not know empty). Lütfen aşağıda İngilizcesi verilen kelimelerin Türkçe karşılıklarını yanlarına yazınız. Bilmediğiniz kelimeleri boş bırakınız.

Alloy =
Leaching =
Sintering =
Density =
Matrix =
Carbon =
Microstructure =
Composite (material) =
Acid =
Deformation =
Fracture =
Metallurgy =
Slag =
Strain =
Voidage =
MPa =
pH (value) =
Oxygen =
Ore =
Titanium =
Interface =
Furnace =
Corrosion =
Fatigue =
Coating =
Oxide =
Hydrogen =
Diffusion =
Pore/Porosity =
Electron =
Magnetic =
Dislocation =
Vacuum =
Coke =
Feed =
Ion =
Morphology =
Microhardness =
Nickel =
Dissolution =
Matte =
Laser =
Coefficient =
Precipitate =

Zinc =
Brittle =
Compact =
Calcium =
Dislocation =
Smelting =
Oxidation =
Residuals/Residual elements =
Plastics (materials) =
Hematite =
Adsorption =
Manganese =
Recrystallization =
Friction =
Diffraction =
Magnesium=
Ductility =
Stainless (steel/iron) =
Shear =
Carbide =
Crystal =
Cast =
Microscope =
Ceramic =
Braze =
Phosphorus =
Elongation =
Concentration =
Austenite =
Equilibrium =
Silicon =
Atom =
Weld =
Silica =
Martensite =
Calcite =
Voidage =
Microscopy =
Tungsten =
Alkali =
Vanadium =
Solidification =
Eutectic / Eutectoid =

Chromium =
Densification =
Magnetite =
Machinability =
Lattice =
Cell =
Conductivity =
Quartz =
Electrolyte =
Tailings =
Propagation =
Anode =
Nucleation =
Sodium =
Clad, cladding =
Vickers (hardness) test =
Drill =
Lithium =
Defect =
Alumina =
Electrode (welding) =
Nitrogen =
Equiaxed =
Spinel =
Liquidus =
Ingot =
Flux =
Texture =
Lime =
Graphite =
Ferrite =
Scrap =
Ultrasonic =
Situ (In situ) =
Galena =
Forging =
Evaporation =
Arc =
Uniaxial =
Plasma =
Zircon =
Superalloys =
Sulphur =
Fusion =

Appendix 4: (Continued)

Alloy =
Leaching =
Sintering =
Density =
Matrix =
Carbon =
Microstructure =
Composite (material) =
Acid =
Deformation =
Fracture =
Metallurgy =
Slag =
Strain =
Voidage =
MPa =
pH (value) =
Oxygen =
Ore =
Titanium =
Interface =
Furnace =
Corrosion =
Fatigue =
Coating =
Oxide =
Hydrogen =
Diffusion =
Pore/Porosity =
Electron =
Magnetic =
Dislocation =
Vacuum =
Coke =
Feed =
Ion =
Morphology =
Microhardness =
Nickel =
Dissolution =
Matte =
Laser =
Coefficient =
Precipitate =
Zinc =
Brittle =
Compact =
Calcium =
Dislocation =
Smelting =
Oxidation =

Residuals/Residual elements =
Plastics (materials) =
Hematite =
Adsorption =
Manganese =
Recrystallization =
Friction =
Diffraction =
Magnesium=
Ductility =
Stainless (steel/iron) =
Shear =
Carbide =
Crystal =
Cast =
Microscope =
Ceramic =
Braze =
Phosphorus =
Elongation =
Concentration =
Austenite =
Equilibrium =
Silicon =
Atom =
Weld =
Silica =
Martensite =
Calcite =
Voidage =
Microscopy =
Tungsten =
Alkali =
Vanadium =
Solidification =
Eutectic / Eutectoid =
Chromium =
Densification =
Magnetite =
Machinability =
Lattice =
Cell =
Conductivity =
Quartz =
Electrolyte =
Tailings =
Propagation =
Anode =
Nucleation =
Sodium =

Clad, cladding =
Vickers (hardness) test =
Drill =
Lithium =
Defect =
Alumina =
Electrode (welding) =
Nitrogen =
Equiaxed =
Spinel =
Liquidus =
Ingot =
Flux =
Texture =
Lime =
Graphite =
Ferrite =
Scrap =
Ultrasonic =
Situ (In situ) =
Galena =
Forging =
Evaporation =
Arc =
Uniaxial =
Plasma =
Zircon =
Superalloys =
Sulphur =
Fusion =
FCC =
Dimples/ing =
Coarsening =
Substrate =
Crucible =
AC =
Granulation =
Filler =
Converter =
Germanium =
Segregation =
ASTM =
HAZ (Heat affected zone) =
Slurry =
Acicular =
Magnification =
Argon =
Stud =
Thermodynamics =
Preheating =

Appendix 4: (Continued)

Chip =
Boron =
Aqueous =
Wrought =
Blasting =
Spectrometer =
Aluminium =
Facet =
Potassium =
Ligament =
ISO =
Fluid =
Cleavage =
Activated =
Mesh =
Crystalline =
Battery =

Susceptibility =
Quench =
Abrasion, abrasive wear =
Pyrites =
Lubricant =
Absorption =
Twin =
Solvent =
Limestone =
Cathode =
Build-up =
Refractory =
Penetration =
Methane =
Macro =
Lamellae =
Filtration =

Solute =
Silicate =
Resistivity =
Flakes =
Shrinkage =
Isostatic =
Fluorescence =
Electrowinning =
Binary =
Bellows =
Annealing =
Anion =
Sigma (phase) =
Plasticity =
Mullite=

Appendix 5: Classroom Activity Word List and Meanings

Alloy	Any combination of a Metal with one or more further metals or nonmetals where an intimate, fairly homogeneous mixture has been achieved by a process such as melting.
Abrasion	Removal of material from a metal surface by hard particles or a hard surface sliding across it.
Absorption	The process whereby material, usually vapour or liquid, is taken within the body of some other material.
AC	Alternating current.
Acicular	Needle-shaped.
Acid	An aqueous solution which produces hydrogen ions, H*, is termed acid. If it produces hydroxyl ions, OH, it is termed alkaline.
Activated	Any material treated in some way to enhance its response to its environment.
Adsorption	The process whereby material, initially present as a vapour, liquid or solid, attaches to the surface of some other material forming a fairly loosely bonded molecular layer.
Alkali	A soluble base which dissociates in water producing OH™ ions.
Alpha (a)	The low-temperature allotrope of titanium with a hexagonal close-packed crystal structure that occurs below the B transus.
Alumina	Aluminiun oxide A103, also termed Corundum. It forms naturally and very rapidly on aluminium exposed to the atmosphere.
Aluminium	A metallic element in common use in a (fairly) pure form or with a few per-cent of alloying elements. In its commercially pure form it has high electrical and thermal conductivity with good resistance to corrosion but low strength.
Anion	A negatively charged Jon. It carries an excess electron and is drawn to the anode.
Annealing	Heating a metal to a temperature at which it becomes fully softened.
Anode	The pole, or the material forming the pole, in an electrolytic cell towards which anions travel.
Aqueous	Relating to water, for example a water environment or water-based solution.
Arc	The passage of an electric current across the gap between two electrodes in vacuum, air or liquid.
Argon	An inert gas used to provide a protective environment for various processes such as Argon arc welding.
ASTM	American Society for Testing Metals.
Atom	The smallest particle of an element that can exist and retain its chemical characteristics.
Austenite	The Phase in which iron or steel has a face centred cubic Crystal structure.
Battery	(1)An Accumulator for storing electricity. (2)A factory containing a number of Forges. (3)Multiple devices operating in concert.
Bellows	A thin-wall tube with circumferential corrugations that allow repeated longitudinal flexing.
Binary	Having two components. The term is often used casually in a metallurgical context in reference to binary Phase diagrams.
Blasting	A process in which hard steel or cast iron Shot, typically a few millimetres in diameter, is projected at a surface to remove scale and other contaminants or to produce a roughened surface providing a good key for subsequent surface treatments such as painting.
Boron	A semi-metallic element occasionally added to steels in small quantities, up to 0.03%, as a deoxidizer etc.
Braze	A joining process in which a metal is melted and introduced to the interface between two components which are not melted in the process.
Brittle	Failing without significant Ductility. Sometimes the term is used to imply susceptibility to failure under impact loading but materials can fail in a brittle manner even under static loads.
Build-up	(1) In Electroplating, the excessive thickness that can develop on projections and corners. (2) In welding, the sequence of deposition of multiple layers or beads to form a bulk weld.
Calcite	A natural mineral, calcium carbonate, CaCO3. In its pure form it is transparent and capable of polarizing light.
Calcium	A metallic element having little commercial application in metallic form.
Carbide	A compound of carbon with some other element(s).
Carbon	A non-metallic element occurring naturally in the long-recognized Allotropic forms of graphite and diamond and the more recently identified form, Buckminsterfullerines.
Cast	(1) The practice of pouring molten metal into a mould and allowing it to solidify. If the resultant item is of approximately the final shape, requiring only final machining and other treatments that do not involve significant deformation, it will be described as a Casting. If the cast item is to be wrought to shape by rolling, forging, etc., it will usually be described as an Ingot. (2) The natural curved form that a wire takes as it is drawn from a reel and allowed to lie unrestrained. Its measure is the diameter of the circle formed when a sufficient length is allowed to lie freely on a horizontal surface.
Cathode	The pole in a cell towards which cations travel.
Cell	A local system of activity, in particular an electrochemical cell.

Appendix 5: (Continued)

Ceramic	A solid compound formed between a metal or metalloid and a nonmetal or a metalloid.
Chip	(1) Small metal particles cut away during machining. (2) A integrated circuit comprising a series of interconnected electronic devices such as transistors, resistors etc.
Chromium	A metallic element having a strong affinity for oxygen but forming a thin impervious oxide coating highly resistant to further attack.
Clad, cladding	(1) The attachment of sheet to a structural framework. (2) The application of a substantial coating of one type of metal to a substrate of another. (3) Canning.
Cleavage	Cracking along specific planes of the Crystal structure producing a low-Ductility fracture.
Coarsening	The increase in Grain size by the process of Grain growth or, in steel, the increase in size, with associated reduction in number, of carbide particles or pearlite plates.
Coating	(1) Any process of applying a surface layer to a component, or the layer itself. (2) The layer of Flux and other materials on some welding Electrodes.
Coefficient	A factor defining the relationship between two components.
Coke	The solid carbonaceous material produced by heating coal in the absence of air.
Compact	The action of compressing powder in a die to form a briquette or the briquette so formed.
Composite (material)	Any combination of two or more individual materials, including metals, ceramics, polymers, etc., in particle, fibre, sheet or bulk form.
Concentration	(1) A local increase in some feature or element. (2) The quantity of one substance contained in another, usually as a percentage.
Conductivity	The (measure of the) ability of a material to transfer heat or electricity.
Converter	A furnace such as that in the Bessemer process in which air is' blown through or across the charge of molten metal to oxidize impurities.
Corrosion	Any process by which a metal reacts chemically or electrochemically with another element in the surrounding environment.
Crucible	A vessel in which metal is melted. Usually, it will be of a size that can be handled manually or with limited mechanical assistance.
Crystal	A volume of solid material with all of its atoms aligned on a lattice . 'Crystal' is often used interchangeably with 'grain'.
Crystalline	It is used, when describing a fracture surface, to indicate a bright, angular, faceted appearance resulting from cleavage along specific crystallographic planes, characteristic of Brittle fracture.
Defect	Generally, any deviation from perfection. However, in a metallurgical context it is usually implicit that the defect has significant consequences in the context as all metals contain defects if examined with sufficient rigour.
Deformation	A change in the form of a body due to stress, thermal change, change in moisture, or other causes. Measured in units of length.
Densification	Various techniques for increasing the density of porous materials including compression and Sintering.
Density	The mass of unit volume of material.
Diffraction	The deflection of a beam of radiation by a grating to form interference patterns.
Diffusion	Spreading of constituents in gases, liquids, or solids; spontaneous movement of atoms/molecules within materials; essential in heat treatments and sintering.
Dimples/ing	Shallow indentations in a surface. They may be a manufacturing defect or they may be deliberate, for example to locate the heads of fasteners.
Dislocation	A major, long-range, irregularity in the alignment of planes of Atoms on the Crystal lattice.
Dissolution	The process of one material dissolving another.
Drill	(1) A Drill bit, i.e. a rotating tool with cutting edges at its tip and flutes along the shank to lead away the Swarf. (2) A drilling machine, i.e. one in which a Drill bit is mounted to drill holes in a workpiece.
Ductility	The ability of a material to deform plastically without fracturing.
Electrode (welding)	An electrical conductor from which the current leaves the supply circuit to enter the weld zone. In thé case of Pressure welding, often termed 'spot welding', the electrode is usually of a copper base alloy combing high conductivity with hot strength.
Electrolyte	A fluid capable of being ionized to carry an electrical current.
Electron	The negatively charged subatomic particle that (in a simple model) circles the nucleus of an atom.
Electrowinning	Processes for extracting metals from ores by electrolysis. See Electrochemistry.
Elongation	The amount by which the original gauge length of a tensile test specimen extends, usually expressed as a Percentage elongation.
Equiaxed	Having approximately the same dimensions in all directions, particularly Grains.
Equilibrium	The state in which all changes are in balance and no further change will occur unless some additional external factor is applied.

Appendix 5: (Continued)

Eutectic / Eutectoid	A eutectic is an intimate mixture of two Solid solutions formed, on a solidifying from a single liquid solution, at the eutectic temperature. Metals mix together in different ways in both the liquid and the solid states.
Evaporation	The formation of a gas from a liquid or solid (although direct evaporation from the solid may be termed 'sublimation'). In a metallurgical context the term often refers to coating processes in which, in a vacuum, a metal is evaporated on a hot filament and deposits on a cold target component.
Facet	A flat, usually brightly reflective, portion of surface on a Crystal or fracture face.
Fatigue	The development of one or more cracks by the repeated application and removal of a Stress significantly less than the tensile strength of the material.
FCC	Face centred cubic.
Feed	(1)The material entering a process or its rate of introduction. (2) The rate at which material is cut.
Ferrite	(1)Iron or steel having a Crystal lattice structure of Body centred cubic form. (2) Iron compounds similar to magnetite, Fe3O4, in which some of the iron is replaced by other metallic elements to give a material having significant ferromagnetic characteristics.
Filler	(1)Material added in the molten state to a Welded, Brazed or Soldered joint by a Filler rod or by a consumable Electrode. (2) Bulking materials such as powder or fibre added to plastics.
Filtration	The separation of a liquid plus solid mixture by passing it through a filter. The liquid produced is the Filtrate.
Flakes	Internal cracks in steel resulting from cooling and transformation stresses and the presence of Hydrogen.
Fluid	Any liquid or gas. Its shape is defined by the containment vessel.
Fluorescence	The emission of light or other electromagnetic radiation by a material while it is being irradiated by incident light or other electromagnetic radiation of shorter wavelength such as ultraviolet and X-rays.
Flux	(1)A material or compound introduced in various processes, usually involving melting or heating, to react with undesirable materials such as impurities in the bulk material or contaminants on the surface. (2)The density of magnetic lines of force. (3) A measure of nuclear intensity, the number of particles per unit volume times the mean particle velocity. (4)Rate of heat input. Units include J/s and Btu/h.
Forging	Deformation of a component set between two approaching tool faces by, mainly, compressive forces.
Fracture	The irregular surface produced when a piece of metal is broken. (Note: The dictionary primarily defines fracture in the context of metals, but the general concept applies).
Friction	The force acting between two contacting bodies in motion relative to each other.
Furnace	A vessel or chamber in which a reaction or heat treatment occurs at a considerably elevated temperature, for example Blast furnace and Annealing furnace.
Fusion	(1)Amalgamation by some process involving melting. In some contexts it may imply merely that all or part of a previously integral material had melted and resolidified. (2) In a Nuclear reaction, the joining of light elements to form heavy elements with associated energy release.
Galena	Lead sulphide, PbS, particularly as the naturally occurring ore.
Germanium	A brittle metallic element. It is a semiconductor much used in electronic devices.
Granulation	Any process for producing metals as granules including pouring through a mesh or onto a spinning disc from which droplets are flung.
Graphite	A form of Carbon with a hexagonal crystal structure having lowfriction characteristics.
Heat affected zone (HAZ)	The zones of unfused parent material at the edge of a weld that have been affected metallurgically by the heat of the welding process.
Hematite	Haematite.
Hydrogen	A gaseous element usually damaging in metals if present in significant quantities.
Ingot	A casting of simple shape that will be subjected to further working operations. The as-cast ingot is normally cropped to remove the top section containing impurities and other defects.
Interface	The boundary or gap between two or more surfaces which are in contact or close proximity.
Ion	The electrically charged particle formed by an Atom or Molecule losing or gaining an electron.
ISO/Iso-	(1) International Standards Organization. (2)(various combinations) Equal.
Isostatic	At equal pressure. In some usages the term indicates that pressure does not vary with time but in terms such as Hot isostatic pressing, it indicates that the pressure acts equally in all directions.
Lamellae	Multiple thin plates stacked as laminations.
Laser	Light Amplification by Stimulated Emission of Radiation. A technique for producing a high-intensity beam of monochromatic coherent light.

Appendix 5: (Continued)

Lattice	The three-dimensional grid on which it is visualized atoms are arranged in the Crystal structure of solid metal.
Leaching	Removal of some constituent of a mixture by dissolution in a solvent.
Ligament	In an engineering context, a load-bearing part of a structure, for example, the metal remaining between a number of holes set across the line of loading.
Lime	The material produced when Limestone is heated above about 850 °C to drive off water and carbon dioxide.
Limestone	Naturally occurring calcium carbonate (CaCO3) rock usually with contaminants such as silica, alumina and other carbonates.
Liquidus	The line on a Phase diagram above which only the liquid phase is stable and below which solidification commences.
Lithium	A metallic element with the lowest density of any metal. It has some limited application as an alloy addition in Light alloys.
Lubricant	Materials imposed at the interface between surfaces in relative motion. Their primary function is to keep the surfaces apart and hence avoid surface damage and seizure.
Machinability	(1) In a metallurgical context, this term reflects the form of the swarf, i.e. the material removed by the cutting tool. (2) In wide production engineering contexts this term may refer to matters such as the energy required for cutting, the rate of wear of the cutting tool or the texture and quality of the cut surface.
Macro	On a large scale as opposed to micro.
Magnesium	A low-density metallic element. It has a strong affinity for oxygen and is significantly corroded in moist environments, particularly if salt laden, but forms a protective oxide film in dry air.
Magnetic	Having the capacity to be attracted by, or repelled by, other magnetized materials or magnetic fields.
Magnetite	Black, magnetic iron oxide, Fe304. In contrast to Rust, magnetite can form a protective coating, for example in high-temperature water of good quality.
Magnification	In Metallography, the ratio of the image diameter to the object diameter.
Manganese	A metallic element having little commercial use in its pure state but an important alloying element in Steel, aluminium and other metals.
Martensite	The structure formed in steels by a shear mechanism, rather than a diffusion process, when the steel is cooled, faster than the critical rate, from the austenitic range.
Matrix	In a metallurgical context, the predominant Phase or material surrounding another phase or feature.
Matte	The impure metal sulphide produced at an intermediate stage in the reduction of a sulphur-rich ore to a metal.
Mesh	Apart from its common meanings, in a metallurgical context this term usually refers to the series of numbered sieves of decreasing mesh hole size used for grading powders.
Metallurgy	In its widest sense, the study of the extraction, production, use and performance of metals.
Methane	CH4g, an inflammable gas.
Microhardness	(1) Resistance to indentation or abrasion. (2) The ability to retain Magnetism when the magnetizing flux is removed. (3) Colloquially, the measure of vacuum.
Micrometer (um)	A dimension of 0.001 mm, written with the abbreviation pm. Also referred to as micron (not recommended).
Microscope	Instrument for examining a material at a high magnification, in particular the Light microscope, or, more strictly, the Compound microscope since it comprises two main lenses. The Objective close to the specimen produces the initial image which is then magnified by the Ocular or Eye piece close to the observer.
Microscopy	The science and practice of examining materials under a microscope.
Microstructure	The arrangement and appearance of Grains, Phases, Inclusions and other features within a metal. It is normally examined by light or electron microscopes.
Morphology	The study of the smallscale external and internal form or structure of a material.
MPa	MegaPascal.
Mullite	An aluminosilicate mineral, 3A1,03.2SiO>2, used as a refractory.
Nickel	A metallic element. It has some limited use in a bulk pure form, for example as coinage or electroplate, but has extensive use in alloy systems where it may be the major or minor component.
Nitrogen	A gaseous element that comprises about 80% of air.
Nucleation	The process by which Solidification or Recrystallization commences at a point or points in the material termed nuclei.
Ore	A natural mineral containing one or more metallic elements in sufficient quantity to be economically extracted.
Oxidation	In its metallurgical sense, the “reaction of a metal with oxygen to form its oxide. In its electrochemical sense, the loss of electrons from a metal during any chemical reaction.

Appendix 5: (Continued)

Oxide	A compound of any element with oxygen.
Oxygen	An element boiling at minus 193°C and hence gaseous at normal temperature and pressure.
Penetration	In fusion welding, it is the depth to which a joint has been fused measured from the outer face. In spot, seam welds, etc. it is the depth of the Nugget measured from the interface. See Figure 50, located at entry on Welding terminology.
pH (value)	The pH of a solution is the negative logarithm to base 10 of the molar hydrogen ion concentration. It is a measure of the acidity /alkalinity of aqueous solutions with a range from about —1 to 15.
Phosphorus	A non-metallic element, undesirable in steel but a deliberate addition to some copper alloys.
Plasma	The condition when, at very high temperature, the atoms in a gas become highly ionized, i.e. partially dissociated releasing some electrons.
Plasticity	The ability to undergo plastic deformation without cracking.
Plastics (materials)	A non-metallic material which, when subject to heat and possibly pressure, becomes sufficiently plastic to be moulded, extruded or otherwise formed to shape. Many, but not all, are Polymers.
Pore/Porosity	Voids in a material. Usually the term implies voids which individually are of small size relative to the section and particularly those resulting from gas entrapment during Solidification.
Potassium	A metallic element. It is violently reactive with water and has negligible commercial application in its pure state.
Precipitate	Particles that emerge from a super-saturated solution.
Preheating	Any deliberate heating before a process intended to confer some benefit.
Propagation	In a metallurgical context, usually the growth of a crack.
Pyrites	Generally, any sulphides including iron pyrites (‘fool’s gold’) and copper pyrites.
Quartz	One of the three forms of silica, SiO).
Quench	Rapidly cool in various media. Common media include, in increasing order of severity, still air, air blast, oil, water, brine.
Recrystallization	The process of forming, in a solid material, a new Grain (crystal) structure, usually during heat treatment of a work-hardened material but also when a metal undergoes a Phase change in the solid state.
Refractory	Historically, the term implied mineral and ceramic materials used in applications such as furnace linings but modern usage includes any material which does not react significantly with its environment and has useful levels of strength for useful periods of time at high temperatures.
Residuals/Residual elements	Any elements in a metal not added deliberately.
Resistivity	Resistance to the passage of electricity. It is the reciprocal of conduction measured, in the SJ System, in microhm centimetres.
Scrap	(1) Material discarded or spoilt and not suitable for continued processing to a finished component. (2) Previously used metal that is suitable for reprocessing, usually remelting, into a product of adequate quality.
Segregation	Variations in impurity and alloy content across a grain or casting.
Shear	(1) The cutting action in which a pair of blades or similar abutting faces slide across each other cutting the entrapped material as with scissors. (2) The type of force that causes or tends to cause two contiguous parts of the same body to slide relative to each other in a direction parallel to their plane of contact.
Shrinkage	Reduction in dimensions resulting from contraction during Solidification and cooling.
Sigma (phase)	An intermetallic compound, particularly iron—chromium, FeCr, but also other compounds having similar complex tetragonal crystallographic structures.
Silica	Silicon oxide, SiO , a mineral which occurs naturally as quatz. It retains good mechanical properties close to its melting point of 1710 °C, has a low coefficient of thermal expansion (5 x 1077 per °C) and hence is widely used as a Refractory.
Silicate	A compound in which silicon is combined with other elements.
Silicon	A Metalloid element. It is a Semiconductor and an important alloying element in many metals.
Sintered (Sintering)	A process, below the melting point but usually at elevated temperature, in which contacting particles mutually diffuse and bond.
Situ (In situ)	In its normal place. In a metallurgical context this Latin term indicates that the item of interest is in its normal location rather than being removed to a laboratory.
Slag	The mixture of Flux and impurities extracted from the metal which forms during various melting processes.
Slurry	A thick suspension of solids in water or other liquid, less viscous than a paste and easily poured.
Smelting	Processes involving chemical reaction at high temperature to reduce Ore to molten metal or to some intermediate product.
Sodium	A metallic element that oxidizes readily in air and reacts violently with water to release hydrogen with the heat of the reaction then igniting the hydrogen.

Appendix 5: (Continued)

Solidification	The process whereby a metal changes, on cooling, from the fully liquid state to the fully solid state.
Solute	The materal taken into Solution by the Solvent.
Solvent	The material that dissolves the Solute material to form a Solution.
Spectrometer	Spectrograph An instrument for producing and displaying the spectrum of radiation emitted by a material when excited by, for example, an electric arc. It can be used for the analysis of metals. Where the instrument measures the intensity of the emission it may be termed a Spectrometer.
Spinel	A simple cubic Crystal lattice found in various minerals. The term is sometimes used specifically for MgAl, Og.
Stainless (steel/iron)	Any iron or steel containing more than about 12% chromium can be termed stainless.
Strain	The unit of change in the size or shape of a body due to force.
Stud	(1) Various components, usually fitments to some larger assembly, which act as connectors, retainers or locating devices. (2) A threaded fastener with both ends threaded, one for insertion into the main body of a component and the other end to carry a nut.
Substrate	The material underlying the surface film or outer layer.
Sulphur	A non-metallic element. It is often encountered in metallic ores, it is usually undesirable even in small quantities and is not easily removed totally.
Superalloys	An imprecise term usually meaning materials significantly superior to high-alloy steels.
Susceptibility	See magnetic. The Magnetic susceptibility is the relative permeability-l.
Tailings	The material left after a lowgrade ore has been concentrated. It will contain some of the desired metal but not in economically recoverable quantities.
Texture	(1) The characteristics of a surface such as roughness, alignment and sharpness of topographical features. (2) Preferred orientation.
Thermodynamic s	The study of the interaction between heat and mechanical energy in any process.
Titanium	A corrosion-resistant metallic element with a density between the light metals, aluminium, etc. and steel.
Tungsten	A dense metallic element still occasionally referred to as Wolfram. It has a high melting point and hence: is used in a near-pure form for the filaments of electric lamps and similar applications.
Twin	An arrangement of the Crystal lattice in which the planes of atoms on adjacent blocks in a crystal are aligned in a mirror image of each other.
Ultrasonic	Sound waves at frequencies above those audible to the human ear.
Uniaxial	Acting or aligned along one axis of a crystal or a component.
Vacuum	A space that is devoid of matter.
Vanadium	A metallic element used mainly as an alloying element. In Steel it acts as strong deoxidizer, improves Hardenability, forms carbides stable to high temperatures and promotes Secondary hardening.
Vickers (hardness) test	A Hardness test utilizing a diamond indentor which is thrust into the component by a known load and the size of the indentation provides a measure of the hardness.
Voidage	The measure, usually a volume percentage, of voids in a material.
Weld	A union formed between two components as a result of local mutual Fusion or Diffusion resulting from heating and/or pressure.
Wrought	Any material that has been shaped by a deformation process, as opposed to a casting.
Zinc	A metallic element having major applications as a corrosion-resisting surface on Steel.
Zircon	A zirconium oxide/silicon oxide compound, ZrO>.SiOp. It is used in powder form, often termed Zircon sand, as a refractory material with good thermal shock resistance up to about 1700 °C.

Appendix 6: GenAI Generated Fill-in-the-Blanks Activities

Fill in the Blanks

Instructions: Fill in the blanks with the correct word from the word bank.
Word Bank: interface, furnace, corrosion, fatigue, coating, oxide, hydrogen, diffusion, pore, electron

1. The boundary between two materials is called an __________.
2. A device used for heating materials to high temperatures is a __________.
3. The deterioration of a material due to chemical reactions is called __________.
4. The weakening of a material due to repeated stress is called __________.
5. A layer applied to a surface to protect it is a __________.
6. A compound formed by the combination of oxygen with another element is an __________.
7. A gas that is highly flammable and lighter than air is __________.
8. The movement of atoms or molecules from one place to another is called __________.
9. A small hole or cavity in a material is a __________.
10. A negatively charged particle in an atom is an __________.

Fill in the Blanks

Instructions: Fill in the blanks with the correct word from the word bank.
Word Bank: alloy, leaching, sintering, density, matrix, carbon, microstructure, composite, acid, deformation

1. A mixture of two or more metals is called an __________.
2. The process of extracting metals from ore using chemicals is called __________.
3. The process of heating and compressing powdered materials to form a solid mass is called __________.
4. The mass of a substance per unit volume is its __________.
5. The background material in a composite material is called the __________.
6. A non-metallic element often found in steel is __________.
7. The internal structure of a material, visible under a microscope, is its __________.
8. A material made up of two or more different materials is a __________.
9. A substance with a pH less than 7 is an __________.
10. A change in the shape of a material due to force is called __________.

Fill in the Blanks

Instructions: Fill in the blanks with the correct word from the word bank.
Word Bank: fracture, metallurgy, slag, strain, sintered, MPa, pH, oxygen, ore, titanium

1. A crack in a material is called a __________.
2. The science of metals is called __________.
3. The waste product formed during metal extraction is called __________.
4. The change in shape of a material under stress is called __________.
5. A material that has been heated and compressed is __________.
6. The unit of stress, MPa, stands for __________.
7. A measure of acidity or alkalinity is the __________ value.
8. A gas essential for combustion and rusting is __________.
9. A naturally occurring rock containing valuable minerals is called __________.
10. A strong, lightweight metal often used in aerospace is __________.

Appendix 7: GenAI Generated Match the Word Activities

Match the Word
Instructions: Match the word on the left with its definition on the right.

Word	Definition
1. Oxidation	A. The process of a substance combining with oxygen
2. Residuals	B. Substances remaining after a process is complete
3. Plastics	C. Synthetic materials that can be molded into various shapes
4. Hematite	D. A common iron ore mineral
5. Adsorption	E. The adhesion of atoms, ions, or molecules from a gas, liquid, or dissolved solid to a surface
6. Manganese	F. A metallic element often used in steel alloys
7. Recrystallization	G. The formation of new crystals from a solution or melt
8. Friction	H. The resistance to motion between two surfaces in contact
9. Diffraction	I. The bending of waves around obstacles or through openings
10. Magnesium	J. A lightweight, silvery-white metal

Match the Word
Instructions: Match the word on the left with its definition on the right.

Word	Definition
1. Matte	A. A dense, metallic intermediate product in smelting
2. Laser	B. A device that emits intense, monochromatic light
3. Coefficient	C. A numerical factor that multiplies a variable
4. Precipitate	D. A solid substance that forms in a solution
5. Zinc	E. A metallic element used in galvanization
6. Brittle	F. Easily broken or shattered
7. Compact	G. Dense and solid
8. Calcium	H. A metallic element essential for bone health
9. Dislocation	I. A defect in a crystal lattice
10. Smelting	J. The process of extracting metal from its ore by heating and melting

Match the Word
Instructions: Match the word on the left with its definition on the right

Word	Definition
1. Magnetic	A. A charged atom
2. Dislocation	B. A defect in a crystal lattice
3. Vacuum	C. An empty space
4. Coke	D. A form of carbon used in metallurgy
5. Feed	E. Input material for a process
6. Ion	F. An atom or molecule with a net electric charge
7. Morphology	G. The shape and structure of a material
8. Microhardness	H. Hardness measured on a microscopic scale
9. Nickel	I. A metallic element
10. Dissolution	J. The process of dissolving a substance in a solvent

Appendix 8: GenAI Generated True or False Activities

True or False: **Instructions:** Determine if each statement is true or false.

1. Voidage refers to the empty space within a material.
2. Microscopy is the technique of using microscopes to examine small objects.
3. Tungsten is a strong, heat-resistant metal often used in light bulb filaments.
4. Alkali metals are highly reactive elements.
5. Vanadium is a metallic element used in steel alloys to improve strength and toughness.
6. Solidification is the process of a liquid changing into a solid.
7. Eutectic and eutectoid points are specific compositions and temperatures in phase diagrams.
8. Chromium is a metallic element often used to improve the corrosion resistance of steel.
9. Densification is the process of reducing the porosity of a material.
10. Magnetite is a magnetic iron oxide mineral.

True or False
Instructions: Determine if each statement is true or false.

1. Ductility is the ability of a material to be drawn into wires.
2. Stainless steel is resistant to rust.
3. Shear stress is a type of stress that causes a material to slide past itself.
4. Carbide is a compound of carbon and another element, often a metal.
5. A crystal is a solid material with an orderly arrangement of atoms.
6. Casting is a manufacturing process where molten material is poured into a mold.
7. A microscope is a tool used to magnify small objects.
8. Ceramic materials are typically brittle and heat-resistant.
9. Brazing is a joining process that uses a filler metal with a lower melting point than the base metals.
10. Phosphorus is a non-metallic element often added to steel to improve its strength and hardness.

True or False
Instructions: Determine if each statement is true or false.

1. Elongation is a measure of a material's ability to stretch under tension.
2. Concentration refers to the amount of a substance in a given volume or mass.
3. Austenite is a phase of iron that exists at high temperatures.
4. Equilibrium is a state of balance or stability.
5. Silicon is a non-metallic element commonly used in semiconductors.
6. An atom is the basic unit of a chemical element.
7. A weld is a joint created by joining two pieces of metal together.
8. Silica is a compound of silicon and oxygen.
9. Martensite is a hard, brittle phase of steel.
10. Calcite is a common mineral form of calcium carbonate.

Appendix 9: GenAI Generated Multiple Choice Activities

Multiple Choice Questions
Machinability is:
A) The ability of a material to be shaped or formed. C) The weight of a material.

B) The hardness of a material.   D) The color of a material.

A lattice is:
A) A type of food. C) A tool used for cutting.

B) An arrangement of points in space. D) A type of fabric.

A cell is:
A) A small room. C) A type of battery.

B) The basic unit of a living organism. D) A unit of measurement.

Conductivity is:
A) The ability of a material to conduct heat or electricity. C) The ability of a material to float.

B) The ability of a material to resist heat. D) The ability of a material to bend.

Quartz is:
A) A type of metal. B) A type of plastic.   C) A type of mineral.   D) A type of gas.

The metal was poured into a mold for __________.

a) penetration   b) ingot   c) flux   d) solidification

The ________ of the fabric was soft and smooth.

a) penetration   b) ingot   c) flux   d) texture

The water ________ the soil.

a) solidified   b) fluxed   c) penetrated   d) ingoted

The molten metal was poured into an __________.

a) texture   b) flux   c) ingot   d) penetration

The ________ of the river was steady and calm.

a) texture   b) solidification   c) ingot   d) flux

Multiple Choice Questions
An electrolyte is:
A) A substance that conducts electricity when dissolved in water.   C) A type of clothing.

B) A type of food.   D) A type of weather.

Tailings are:
A) The waste material left over from mining.   C) The leaves of a tree.

B) The feathers of a bird.   D) The hair of an animal.

Propagation is:
A) The spreading or breeding of something.   C) The building of a house.

B) The cooking of food.   D) The driving of a car.

Appendix 10: GenAI Generated Translation Activities

Translation
Instructions: Translate the sentences below

- The place where two things meet is called an interface.
- A furnace is a hot oven used to heat metals.
- When metal rusts, it's called corrosion.
- If you bend a metal wire back and forth many times, it can break due to fatigue.
- A coating is a layer that covers a metal to protect it from corrosion.
- Rust is an example of an oxide.
- When two surfaces rub against each other, it creates friction.
- Diffraction is the bending of waves, like light, around obstacles.
- Smelting is the process of heating rocks to extract metals.
- A magnifying glass makes things look bigger.

Appendix 11: Top 800 Words for Each Sub-Corpus

Ceramic Materials		Material Science		Metallurgy		Polymer Science and Technology	
Item	Frequency	Item	Frequency	Item	Frequency	Item	Frequency
al	1026	fig	3018	al	5378	composites	1649
thermal	771	al	1857	fig	3932	fiber	1434
ceramic	571	alloy	965	ti	3088	matrix	1073
ceramics	566	cu	943	fe	2734	mm	1012
wt	552	fe	832	alloy	2168	al	902
sic	515	ti	827	et	1888	tensile	806
si	501	et	806	leaching	1632	thermal	800
x	492	ni	693	mg	1554	fibers	742
sintering	492	alloys	660	cu	1536	resin	698
density	473	fatigue	658	min	1468	polymer	668
conductivity	458	microstructure	599	sintering	1368	epoxy	660
mm	449	density	584	zn	1300	et	646
cm	447	co	566	density	1270	strain	627
tio	401	mm	541	alloys	1220	cm	550
min	401	matrix	482	si	1196	carbon	542
xrd	384	strain	480	matrix	1154	filler	538
porosity	360	welding	477	mm	1108	wt	482
co	352	deformation	463	α	1102	min	472
matrix	347	interface	461	mn	1072	fe	472
et	346	x	445	carbon	1072	peak	465
peak	335	pani	437	microstructure	1070	specimens	445
alumina	319	cm	411	co	1062	friction	423
laser	312	mpa	398	wt	980	hybrid	417
microstructure	301	thermal	384	composites	964	pvdf	407
peaks	300	fracture	362	acid	956	dielectric	403
fe	284	min	354	deformation	932	modulus	398
mgo	283	laser	354	fracture	922	shear	361
mpa	282	electron	346	machining	910	fracture	360
dielectric	279	eutectic	345	metallurgy	904	conductivity	357
compressive	268	titanium	323	slag	858	deformation	356
composites	265	pores	321	strain	852	bt	351
cement	264	carbon	306	sintered	834	specimen	333
sio	261	tensile	299	sinter	794	fabric	331
cr	259	zr	295	mpa	790	gf	328
ti	256	dcm	283	ph	784	density	327
nm	254	cr	281	oxygen	784	cfrp	326
sintered	249	peak	280	ore	772	absorption	326
crystalline	248	mo	280	tensile	762	cnts	311
corrosion	242	porosity	277	ni	750	foam	310
electron	237	conductivity	277	fraction	718	pla	291
geopolymer	234	composites	273	titanium	710	laminates	291
sem	233	metallurgical	271	zone	708	coating	291
absorption	232	α	270	precipitation	674	rgo	290
ions	229	sem	267	mgo	662	mpa	288
ca	221	specimens	259	interface	654	co	272
zno	214	nm	254	specimens	630	velocity	270
fracture	214	mg	250	metallurgical	622	laminate	267
oxide	211	si	248	furnace	606	coefficient	263
mg	209	diffusion	247	cr	596	fillers	262
carbon	209	crystal	241	corrosion	596	peaks	258
oxygen	207	eq	240	pre	572	cf	253
diffraction	203	wt	239	sem	566	aramid	252
calcium	203	plastic	239	x	564	pa	251
nb	202	graphene	238	thermal	538	interfacial	250
refractory	201	friction	234	fatigue	538	ptfe	248
compositions	196	dislocation	232	coating	532	bn	246
pore	190	aluminum	230	β	530	bnns	232
specimens	188	lattice	227	oxide	528	molecular	231
lattice	186	weld	223	µm	526	acid	231
mol	185	sintering	223	weld	506	non	225
scanning	184	electrode	222	hydrogen	504	x	221
modulus	184	xrd	219	γ	488	compressive	221
fiber	184	β	216	na	482	magnetic	220
precursor	179	ii	216	diffusion	478	viscosity	218
crystal	178	oxide	214	ta	470	nanoparticles	217

Appendix 11: (Continued)

spectra	172	specimen	213	porosity	464	epdm	216
radiation	169	γ	210	diameter	464	sem	207
ce	168	cell	209	zno	454	adhesion	207
diameter	167	cnts	206	compacts	454	µm	204
furnace	166	braking	205	pm	452	adhesive	201
β	159	sic	203	xrd	448	sio	198
amorphous	159	austenite	203	welding	438	oxygen	198
phosphate	158	peaks	201	electron	438	graphene	197
cnt	155	lignin	199	cnts	436	degradation	196
fibers	151	cells	197	magnetic	434	flexural	193
ag	151	fs	196	sio	432	compression	193
kaolinite	148	coefficient	194	dislocation	428	diameter	192
na	146	µm	191	exergy	410	interface	191
µm	145	morphology	186	ca	406	poss	190
cu	145	magnetic	181	vacuum	402	peg	190
pores	144	pore	180	eds	402	dispersion	185
doped	143	martensite	180	coke	398	polymers	184
hfc	142	atoms	180	specimen	396	nanocomposites	183
microwave	140	zone	179	non	396	additionally	182
ipg	138	compressive	178	feed	396	cnt	181
synthesis	136	ceramic	177	ions	394	patch	179
θ	134	oxygen	174	morphology	382	mold	178
coefficient	134	doped	172	cm	382	vibration	171
inclusions	133	shear	167	microhardness	380	cellulose	171
hf	132	tem	162	tibw	372	molding	167
cuo	132	diffraction	159	nickel	372	scanning	166
mn	131	residual	158	dissolution	372	ldpe	166
eds	131	fraction	158	matte	362	collagen	165
µm	130	defects	158	laser	352	pp	164
residual	130	sintered	157	pb	350	nanocomposite	163
morphology	129	atomic	157	nd	348	linear	162
ml	129	diameter	155	pores	344	yarn	159
mb	129	ev	154	ml	344	micro	157
zn	128	pm	153	kg	332	graphite	157
viscosity	128	fr	153	oxides	330	morphology	155
crystallization	128	ion	152	mol	328	elongation	154
strain	127	ductility	149	coefficient	326	crystallization	154
activated	127	ml	147	rpm	324	cell	154
spectroscopy	126	oxidation	144	precipitate	324	si	152
porous	126	cof	144	micro	324	pe	152
la	126	welded	143	molten	320	stacking	149
ev	126	microscopy	142	eq	316	plasma	149
oxides	125	optical	139	peaks	312	vinyl	148
z	124	microstructures	139	zinc	310	nano	148
aluminum	123	non	138	brittle	308	membrane	147
cf	122	mos	136	compact	306	fkm	147
molar	121	electronic	136	calcium	302	ltd	144
defects	121	eds	134	microstructural	298	delamination	143
activation	121	lm	133	dislocations	298	laminated	142
decomposition	120	tg	131	peak	296	nm	141
oxidation	119	metallurgy	131	µm	294	pg	139
densification	119	pb	129	smelting	294	cuo	139
bubble	119	cfs	129	oxidation	294	etching	138
molten	117	thermoelectric	128	residual	280	pai	137
cell	116	polymer	128	mo	280	oxide	137
pmma	115	gradient	128	plastic	274	stf	135
specimen	113	defect	127	hematite	274	il	135
quartz	112	doping	125	adsorption	272	ml	134
nanoparticles	112	scanning	124	nh	268	pu	133
filler	111	modulus	124	tio	266	polymerization	132
aln	111	fa	124	scanning	262	cpeur	132
fraction	110	alloying	124	manganese	262	mwcnt	130
glaze	108	adhesion	124	recrystallization	258	decomposition	130
carbonate	108	corrosion	122	friction	258	ftir	127
synthesized	107	perovskite	121	sz	256	conductive	126
non	107	hea	121	diffraction	256	spectra	125
ceo	106	electrochemical	121	flotation	254	ppo	125

Appendix 11: (Continued)

shrinkage	105	polymerization	119	magnesium	252	coatings	125
shear	105	micro	119	ductility	252	china	125
alkali	105	absorption	119	additionally	250	vacuum	124
zro	104	z	118	emissions	248	plla	124
atmosphere	104	molecular	118	ctr	248	gnps	124
schist	103	microstructural	118	residue	246	tg	122
gel	101	ions	118	solar	244	storage	122
silica	100	dislocations	114	microstructures	244	silicone	122
mortar	100	wc	113	stainless	238	kevlar	121
electronic	100	cf	113	shear	238	fraction	119
smp	99	bi	113	carbide	238	electron	119
doping	99	inclusions	112	pore	236	coated	119
å	98	diagram	112	crystal	236	yarns	118
ion	98	vacuum	111	gb	234	crystalline	118
interface	98	snse	111	fabricated	234	polymeric	117
linear	97	sz	110	decomposition	234	interlaminar	117
emission	96	substrate	110	metallic	232	plastic	116
electrode	96	nx	109	casting	232	pei	116
geopolymers	95	ma	108	optimal	230	pbat	116
calcined	95	densification	108	microscope	230	demolding	116
magnetic	94	ceramics	108	machined	230	crystal	116
sialon	93	acid	108	atmosphere	230	af	116
ff	93	propagation	107	extrusion	228	optimal	115
degradation	93	mof	107	nanoparticles	226	molecules	115
optical	92	bcc	107	ceramic	226	ppm	114
microscopy	92	clinker	106	aluminum	224	mw	114
mesh	92	carrier	106	brazing	222	dsc	114
nio	91	nanoparticles	105	phosphorus	220	β	113
sodium	90	hydrochar	105	pg	218	pre	113
er	90	synthesis	104	nm	218	pda	113
bs	90	precipitation	104	elongation	216	spectrum	110
acid	90	adsorption	104	optical	214	sc	110
nitrogen	89	nb	103	elemental	214	ath	110
dissolution	89	qds	102	species	212	poly	109
bzy	89	ferrite	102	wz	210	bio	109
silicon	88	gpa	101	feo	210	ws	108
pyrolysis	88	tpf	100	pyrolysis	208	pf	108
cecro	88	mbgs	100	ferronickel	208	crystallinity	108
silicate	87	intermetallic	100	precipitated	206	antimicrobial	108
nanofibers	87	compositions	99	cao	206	adsorption	108
α	86	θ	98	concentrations	202	mps	107
calcite	86	hydrogen	98	compaction	202	fabrics	107
wc	85	disk	98	cp	200	lightning	106
graphite	85	vibration	97	austenite	200	ola	105
diffusion	85	storage	95	dextrin	198	cof	105
cenosphere	85	shrinkage	95	sulfate	196	ε	104
software	84	electrons	95	steels	194	sensor	103
purity	84	nicon	94	nano	194	resins	103
irradiation	84	synthesized	93	inclusions	194	fluid	102
interfacial	84	te	92	fsw	194	peek	101
chap	84	nhl	92	activation	194	cmc	101
additionally	84	microscope	92	sic	192	barrier	101
ta	83	hybrid	92	rees	190	polarization	100
polarization	83	fcc	92	ores	188	depicted	100
organic	83	elemental	92	exit	188	vs	99
hydrogen	83	additionally	92	resin	186	residual	99
concentrations	83	ph	91	leachate	186	injection	98
rm	82	ht	91	equilibrium	186	static	97
impurities	82	compression	91	silicon	184	buckling	97
dense	82	superior	90	purity	182	ballistic	97
conduction	81	etc	90	dispersion	182	þ	96
zr	80	conduction	90	compressive	182	hydrogel	96
spinel	80	precipitates	89	atoms	182	cme	96
spectrum	80	alumina	89	welds	178	baso	95
voltage	79	cnt	88	tem	178	superior	94
pc	79	binary	88	silica	178	porosity	94
tga	78	metallic	87	reforming	178	pmp	94

Appendix 11: (Continued)

flexural	78	hzo	87	martensite	178	extrusion	94
versus	77	heas	87	deformed	178	silica	93
thermocouple	77	fabricated	87	crb	178	xrd	92
ph	77	disc	87	calcite	178	hydrogen	92
fractions	77	steels	86	voidage	176	tic	91
excitation	77	multi	86	scheelite	176	hpnc	91
elemental	77	debris	86	microscopy	176	lm	90
sn	76	casting	86	blast	176	usa	88
concrete	76	spectra	85	tungsten	174	oven	88
bi	76	phonon	85	precipitates	174	mwcnts	88
rh	75	molten	85	molar	174	laser	88
polymer	75	ws	84	wc	172	impactor	88
magnesium	75	porous	84	jarosite	172	concentrations	88
kv	75	hydration	84	fc	172	astm	88
thermodynamic	74	fiber	84	alloying	172	woven	86
ir	74	cast	84	alkali	172	uv	86
cz	74	pa	83	hv	170	starch	86
zrc	73	entropy	83	az	170	optimization	86
hap	73	σ	82	vanadium	168	jute	86
cao	73	sn	82	solidification	168	hydroxyl	86
strengths	72	cs	82	inter	168	height	85
photocatalytic	72	ald	82	heas	168	gnp	85
mo	72	ternary	81	dissolved	168	microscopy	84
microscope	72	mmc	80	ii	166	mg	84
carbide	72	voltage	79	eutectic	166	ions	84
dye	71	pristine	79	ch	166	ablation	84
cnts	71	mgs	79	nb	164	mgal	83
aluminosilicate	71	fgd	79	impurities	164	mesh	83
zinc	69	sbcb	78	compositions	164	dispersed	82
lapo	69	raman	78	chromium	162	thermoplastic	81
densities	69	plasticity	78	thermodynamic	160	solvent	81
znal	68	phosphorus	78	depicted	160	nanofiber	81
titanium	68	organic	78	densification	158	warping	80
species	68	nano	78	magnetite	156	lattice	80
scan	68	imcs	78	machinability	156	hmx	80
resistivity	68	feconialsi	78	lattice	156	fabricated	80
microstructural	68	feconial	78	emission	154	zone	79
magnesia	68	tio	77	cell	154	tissue	79
raman	67	rms	77	caco	154	br	79
hydroxide	67	nn	77	dri	152	slot	78
electrons	67	ndb	77	sm	148	optical	78
atomic	67	extrusion	77	vapor	146	auxetic	78
additives	67	carbide	77	porous	146	amorphous	78
x	66	ultrasonic	76	correlation	146	absorbed	78
xps	66	polymers	76	pa	144	α	77
slag	66	interfaces	76	lamellar	144	strands	77
metallic	66	bts	76	graphene	144	quasi	77
membranes	65	atom	76	conductivity	144	nanosheets	77
lsc	65	stainless	75	cenosphere	144	microstructure	77
crystals	65	nanostructures	75	ag	144	ldhns	77
bnt	65	hv	75	vibration	142	configuration	77
ac	65	synthetic	74	mtr	142	θ	76
zone	64	solidification	74	jacobsite	142	ð	76
nucleation	64	ontology	74	figs	142	antiviral	76
cathode	64	mn	74	dispersed	142	radiation	75
slfs	63	keyhole	74	cnt	142	ceo	75
precursors	63	brake	74	quartz	140	additives	75
zrb	62	nucleation	73	optimum	140	acoustic	75
wmh	62	kg	73	hspt	140	lignin	74
sofc	62	interfacial	73	diagram	140	fsnc	74
cells	62	inorganic	73	sphalerite	138	dkgc	74
atoms	62	å	72	mno	138	copolymer	74
wavelength	61	zno	72	kj	138	τ	73
deformation	61	software	72	electrolyte	138	synthesized	73
alloy	61	morphologies	72	tailings	136	mxene	73
height	60	iii	72	propagation	136	ch	73
evaporation	60	hof	72	anode	136	alginate	73

Appendix 11: (Continued)

λ	59	coated	72	welded	134	ver	72
scanned	59	η	71	partitioning	134	tga	72
polycrystalline	59	sps	71	ma	134	strand	72
po	59	linear	71	kinetics	134	prepreg	72
ionic	59	equilibrium	71	gravity	134	ph	72
deposition	59	brittle	71	captopril	134	kn	72
zirconia	58	figs	70	rafm	132	infrared	72
uhtcs	58	fibers	70	nucleation	132	iii	72
castable	58	cja	70	novel	132	diffraction	72
brazing	58	kinetics	69	intermetallic	132	crosslinking	72
batch	58	fju	69	cucr	132	pkcss	71
ablation	58	zt	68	crystals	132	disc	71
pozzolanic	57	sb	68	tic	130	debonding	71
nps	57	novel	68	sodium	130	kenaf	70
germany	57	crystals	68	clad	130	hz	70
coating	57	complexions	68	caso	130	axial	70
calcination	57	slag	67	vredenburgite	128	alloys	70
xrf	56	pt	67	vickers	128	voids	69
refractive	56	nicop	67	software	128	transverse	69
reference	56	mol	67	rotational	128	sr	69
profile	56	forging	67	recrystallized	128	sbpeh	69
li	56	biological	67	fractions	128	propagation	69
laco	56	ucs	66	drilling	128	projectile	69
iii	56	silicon	66	cs	128	pore	69
defect	56	rivet	66	rotating	126	polyester	69
debond	56	rafm	66	lithium	126	newtonian	69
correlation	56	fabrication	66	ion	126	microscope	69
conductive	56	electrodes	66	imcs	126	interlayer	69
sicn	55	coating	66	fabrication	126	diluent	69
pellets	55	recrystallization	65	ebsd	126	nitrogen	68
kg	55	radiation	65	defects	126	inlet	68
insulation	55	pmf	65	alumina	126	fma	68
hz	55	graphite	65	recycling	124	electronic	68
fs	55	dhtp	65	nanocomposite	124	cu	68
dissolved	55	deformed	65	linear	124	residue	67
carriers	55	dataset	65	leached	124	ply	67
virgin	54	boron	65	ge	124	pi	67
stoichiometric	54	substrates	64	electrode	124	patches	67
oven	54	heterostructures	64	zhang	122	mil	67
ncm	54	bmh	64	purification	122	hydrogels	67
gpa	54	proteins	63	calcine	122	copolymers	67
diagram	54	mobility	63	radiation	120	tpi	66
uv	53	durability	63	oxalic	120	software	66
sm	53	cnn	63	nitrogen	120	penetration	66
hydration	53	bacteria	63	modulus	120	organic	66
flux	53	κl	62	misorientation	120	hemp	66
cementitious	53	zn	62	maed	120	fabrication	66
vapor	52	profile	62	leach	120	rebars	65
pva	52	pre	62	fsp	120	pur	65
probe	52	dopant	62	equiaxed	120	impregnated	65
applicator	52	catalyst	62	velocity	118	cv	65
wettability	51	atmosphere	62	spwl	118	alkyl	65
refractories	51	ag	62	spinel	118	spectroscopy	64
lc	51	tns	61	nanocomposites	118	sensing	64
indentation	51	pmc	61	sulfuric	114	ribs	64
grin	51	nickel	61	residues	114	marine	64
dpbha	51	haz	61	liquidus	114	breakdown	64
sps	50	densified	61	li	114	nanofibers	63
pellet	50	sub	60	ingot	114	multi	63
mno	50	strains	60	etc	114	defects	63
inert	50	spectroscopy	60	drill	114	con	63
immersion	50	simultaneously	60	soluble	112	ceramic	63
ii	50	segregation	60	pr	112	bfrp	63
geometry	50	emi	60	interfacial	112	aerospace	63
dsc	50	drx	60	im	112	toughened	62
cubic	50	dispersion	60	homogeneous	112	ipb	62
bv	50	cubic	60	chalcopyrite	112	blends	62

Appendix 11: (Continued)

scncs	49	annealing	60	uf	110	bismuth	62
opc	49	zro	59	spectroscopy	110	rpm	61
microstructures	49	velocity	59	organic	110	mos	61
fatigue	49	tib	59	globular	110	frp	61
vacuum	48	radius	59	flux	110	corrosion	61
tg	48	nitride	59	compression	110	vibrations	60
pre	48	nial	59	carbonate	110	rib	60
membrane	48	mv	59	z	108	radial	60
infrared	48	monolayer	59	ys	108	nh	60
cavity	48	homogeneous	59	texture	108	naoh	60
bauxite	48	extruded	59	sulphuric	108	microstructures	60
vacancies	47	emission	59	slags	108	inorganic	60
tbzbf	47	cntf	59	lime	108	ii	60
reactivity	47	ρ	58	graphite	108	filtration	60
ma	47	sf	58	ferrite	108	correlation	60
leaching	47	sd	58	scrap	106	tribological	59
gehlenite	47	physics	58	precursor	106	nanotubes	59
dependence	47	pellets	58	naoh	106	ckhs	59
alkaline	47	nitrogen	58	multi	106	rheological	58
vl	46	evaporation	58	hausmannite	106	polyethylene	58
precipitation	46	dft	58	hanks	106	oxidation	58
homogeneous	46	aniline	58	ductile	106	humidity	58
foams	46	simulations	57	uts	104	ha	58
fluoride	46	furnace	57	ultrasonic	104	grafted	58
fluence	46	bacterial	57	superior	104	voltage	57
eq	46	þ	56	situ	104	precursors	57
droplet	46	silica	56	rht	104	pmblr	57
bm	46	nfa	56	galena	104	optimum	57
batio	46	lamellar	56	axis	104	moisture	57
σ	45	eutectics	56	forging	102	ev	57
spectral	45	em	56	evaporation	102	benzoxazine	57
solubility	45	decomposition	56	ebm	102	toluene	56
ni	45	δk	55	china	102	plastics	56
mgcl	45	plasma	55	cast	102	packaging	56
gradient	45	oxides	55	arc	102	cur	56
dispersive	45	dispersed	55	uniaxial	100	stacked	55
depicted	45	discharge	55	atmospheric	100	gpa	55
ch	45	depicted	55	zones	98	seaweed	54
tensile	44	crystallinity	55	scan	98	prepregs	54
profiles	44	capacitance	55	plasma	98	pc	54
ppm	44	spectrum	54	kv	98	mobility	54
piezocatalysis	44	rivets	54	electrochemical	98	homogeneous	54
metakaolin	44	nanofibers	54	basal	98	ethanol	54
laboratory	44	martensitic	54	solubility	96	dissipation	54
infiltration	44	magnesium	54	shaft	96	xps	52
impedance	44	activation	54	icp	96	membranes	52
hp	44	vickers	53	correlations	96	lubricant	52
glassy	44	sulfide	53	breakout	96	foams	52
fig	44	situ	53	bof	96	alloy	52
brazed	44	rpm	53	bf	96	warp	51
tm	43	olive	53	atomic	96	tpe	51
sylramic	43	janus	53	ammonium	96	tendon	51
simulations	43	geometry	53	zircon	94	synthesis	51
scms	43	fsw	53	superalloys	94	substrate	51
recyclate	43	fluoride	53	sulphur	94	sodium	51
propagation	43	ebsd	53	reference	94	reference	51
ltd	43	bimetal	53	ra	94	nanoparticle	51
ldh	43	tmm	52	fusion	94	nanofillers	51
hec	43	laboratory	52	fcc	94	cnf	51
anorthite	43	gn	52	dimples	94	abrasion	51
f	42	adhesive	52	coarsening	94	pes	50
μa	42	tungsten	51	abrasive	94	outlet	50
optimal	42	resin	51	scft	92	optimized	50
npg	42	optimal	51	ltd	92	gb	50
moisture	42	nd	51	kinetic	92	cylindrical	50
inorganic	42	mosse	51	hea	92	cells	50

Appendix 11: (Continued)

entropy	42	latent	51	ammonia	92	catalyst	50
electrodes	42	concentrations	51	substrate	90	bridging	50
cemn	42	cement	51	negligible	90	snc	49
boehmite	42	cc	51	kw	90	pores	49
threshold	41	astm	51	hdh	90	mma	49
ssa	41	algorithm	51	ev	90	insulation	49
rd	41	af	51	dispersive	90	hg	49
pristine	41	vs	50	crucible	90	er	49
nano	41	valence	50	acids	90	epar	49
mc	41	polymeric	50	ac	90	durability	49
crystallite	41	nfas	50	θ	88	differential	49
ba	41	kv	50	phosphate	88	brrts	49
static	40	flexural	50	mineralogy	88	bioplastic	49
sensor	40	elongation	50	lubrication	88	weft	48
scans	40	complexion	50	height	88	torque	48
mullite	40	alcu	50	granulation	88	regression	48
mortars	40	tc	49	filler	88	mah	48
crystallinity	40	ss	49	extruded	88	ir	48
crucible	40	polarization	49	cylindrical	88	germany	48
bubbling	40	optimized	49	cubic	88	filaments	48
ann	40	magnitude	49	converter	88	antibacterial	48
vibration	39	kiln	49	cobalt	88	amino	48
tyranno	39	fusion	49	steelmaking	86	wp	47
thermally	39	elevated	49	sponge	86	situ	47
optimum	39	densities	49	sludge	86	mpn	47
iodine	39	citse	49	simultaneously	86	magnitude	47
frequencies	39	thermo	48	sf	86	fractions	47
eutectic	39	solute	48	irms	86	filament	47
de	39	se	48	injection	86	configurations	47
compact	39	resistivity	48	germanium	86	titanium	46
storage	38	oer	48	geometry	86	segments	46
solidification	38	hrtem	48	gaseous	86	moduli	46
rietveld	38	deposition	48	falcon	86	microscopic	46
portland	38	crystalline	48	enriched	86	kinetic	46
magnitude	38	ca	48	unreinforced	84	implants	46
gamma	38	uv	47	turbine	84	hydrophobic	46
emissions	38	strengths	47	threshold	84	gff	46
compression	38	segmentation	47	segregation	84	efficacy	46
bandgap	38	photocatalytic	47	micrographs	84	aluminum	46
anisotropic	38	irradiation	47	increment	84	agglomeration	46
adsorption	38	ipn	47	hno	84	wicking	45
T	37	hcl	47	foaming	84	synthetic	45
iv	37	battery	47	astm	84	rpp	45
embedded	37	bainite	47	þ	82	raman	45
compacts	37	austenitic	47	synergistic	82	ps	45
carbothermal	37	amorphous	47	hp	82	piezoelectric	45
bo	37	template	46	haz	82	phenolic	45
au	37	sns	46	filter	82	nmr	45
phosphor	36	precipitate	46	efficiencies	82	layup	45
phosphates	36	nitriding	46	dosage	82	hygrothermal	45
kaol	36	metastable	46	cfa	82	fluids	45
gmbh	36	electromagnetic	46	xrf	80	covalent	45
equilibrium	36	crystallization	46	xal	80	coefficients	45
electrolyte	36	correlation	46	voltage	80	abs	45
dose	36	cellular	46	slurry	80	abaqus	45
diffusivity	36	λ	45	metallographic	80	ta	44
crosslinking	36	αp	45	fepo	80	synergistic	44
coatings	36	reference	45	feeding	80	sur	44
caco	36	mgo	45	bm	80	polarized	44
aqueous	36	detachment	45	agglomeration	80	laboratory	44
tile	35	aqueous	45	acicular	80	kv	44
radius	35	viscosity	44	aa	80	kg	44
plots	35	tpfa	44	tribological	78	inter	44
optimized	35	lptr	44	superalloy	78	geometry	44
nsic	35	dual	44	sibm	78	fsc	44
np	35	dispersive	44	hydroxide	78	foaming	44
nbm	35	ucr	43	hydrometallurgical	78	fatigue	44

Appendix 11: (Continued)

nanoscale	35	pu	43	gpa	78	electromagnetic	44
kα	35	nh	43	foam	78	cavity	44
kinetics	35	monomer	43	deposits	78	atmosphere	44
hfo	35	li	43	uvefsw	76	acrylate	44
ftir	35	heterogeneous	43	sulfur	76	γ	43
diffractometer	35	favorable	43	storage	76	viscoelastic	43
deposited	35	ductile	43	spinels	76	unidirectional	43
axis	35	alignment	43	premix	76	tpu	43
astm	35	ye	42	optimization	76	symmetric	43
ρ	34	symmetry	42	morphologies	76	sp	43
V	34	probe	42	mmcs	76	sectional	43
wb	34	kinetic	42	magnification	76	polyol	43
volcanic	34	increment	42	hydrochloric	76	phragmites	43
rpm	34	gbs	42	depicts	76	pekk	43
micro	34	esr	42	citric	76	nucleating	43
ht	34	chitin	42	cavities	76	isocyanate	43
foam	34	cao	42	argon	76	graft	43
fluid	34	xps	41	amcs	76	equilibrium	43
ex	34	vibrations	41	airfoil	76	strengths	42
ct	34	optimization	41	stud	74	srrts	42
blended	34	hetero	41	silfm	74	shanghai	42
thermo	33	filler	41	semi	74	mlf	42
setup	33	edx	41	recoveries	74	gel	42
quenched	33	dopants	41	jetleach	74	ga	42
pt	33	csbr	41	goethite	74	doe	42
potassium	33	coefficients	41	carbides	74	brake	42
perovskite	33	axis	41	technologies	72	bacteria	42
isothermal	33	abrasive	41	radius	72	tio	41
insulating	33	semiconductor	40	lunar	72	sandwich	41
fillers	33	msle	40	ltvm	72	polyurethane	41
feldspar	33	molecules	40	laths	72	palm	41
exothermic	33	membrane	40	interlocking	72	novel	41
dc	33	compaction	40	iii	72	monomer	41
cte	33	chamber	40	fuel	72	mol	41
bt	33	cfd	40	fractured	72	matrices	41
anatase	33	antibacterial	40	flg	72	fea	41
analyzer	33	amplitude	40	edx	72	dual	41
agglomeration	33	thermodynamic	39	desorption	72	dp	41
δ	32	sa	39	combustion	72	dkc	41
σd	32	nanocomposite	39	coefficients	72	deposition	41
zirconium	32	loops	39	chamber	72	uhmwpe	40
wastewater	32	heterostructure	39	å	70	sre	40
sealant	32	gel	39	thermodynamics	70	seawater	40
pzt	32	fesem	39	sulphide	70	pir	40
plot	32	dos	39	preheating	70	oc	40
nicalon	32	compacts	39	plotted	70	nonlinear	40
mosi	32	cl	39	mc	70	msccos	40
monoclinic	32	catalytic	39	densities	70	grafting	40
lzo	32	carbides	39	cladding	70	debris	40
granite	32	ar	39	chip	70	ca	40
flinak	32	usa	38	boron	70	analyzer	40
ambient	32	static	38	aqueous	70	amplitude	40
wollastonite	31	semi	38	ε	68	acrylic	40
sr	31	seebeck	38	wlsr	68	verified	39
spectrometer	31	orr	38	smelters	68	tack	39
solvent	31	hf	38	reo	68	strains	39
rf	31	ge	38	reagent	68	slurry	39
octahedral	31	electrolyte	38	pellets	68	polypropylene	39
novel	31	dielectric	38	nahco	68	pdbs	39
mapping	31	brazing	38	morrell	68	nanofiller	39
japan	31	batteries	38	interlayer	68	longitudinal	39
irradiated	31	αs	37	furnaces	68	hydrophilic	39
interfaces	31	wrs	37	fesem	68	crystals	39
electrochemical	31	vector	37	electrodes	68	biodegradable	39
chemistry	31	stud	37	circuit	68	anova	39
batches	31	sericin	37	cft	68	z	38

Appendix 11: (Continued)

attenuation	31	quantum	37	analyzer	68	unfilled	38
annealing	31	pulp	37	adsorbed	68	spectrometer	38
ysz	30	plastics	37	wrought	66	smjf	38
sg	30	pd	37	sub	66	semi	38
pszt	30	nanosheets	37	ss	66	rsm	38
pps	30	elimite	37	spectrum	66	polar	38
nominal	30	chromium	37	profile	66	plies	38
nanoparticle	30	bm	37	microscopic	66	oxidized	38
kinetic	30	affinity	37	lath	66	lateral	38
hydrothermal	30	sved	36	hydrothermal	66	kh	38
ferroelectric	30	stacking	36	elevated	66	japan	38
dopant	30	species	36	ehpa	66	hydrophilicity	38
deionized	30	quantitative	36	degradation	66	drilled	38
corrosive	30	pixel	36	columnar	66	conduction	38
chromium	30	nanoscale	36	blended	66	bisphenol	38
cealo	30	gc	36	blasting	66	π	37
casting	30	gb	36	aisi	66	thermogravimetric	37
carbonation	30	catalysts	36	traverse	64	thermo	37
bruker	30	ascribed	36	syngas	64	sensors	37
bct	30	vacancies	35	spectrometer	64	robust	37
ar	30	uts	35	reformed	64	perpendicular	37
δ	29	ultra	35	rcog	64	molded	37
zeiss	29	sulfur	35	quantitative	64	etc	37
velocity	29	mapping	35	hcl	64	dma	37
superior	29	lamellae	35	favorable	64	dissolved	37
stacking	29	ef	35	endothermic	64	digital	37
pyrolyzed	29	deposited	35	droplets	64	concrete	37
plastic	29	database	35	correlated	64	automotive	37
pdf	29	csa	35	cog	64	adhesives	37
nitrate	29	bubbles	35	chips	64	σ	36
melter	29	µm	34	centrifugal	64	tr	36
magnification	29	workpiece	34	aluminium	64	segment	36
granular	29	vertical	34	zro	62	pmps	36
fa	29	thicknesses	34	sulphides	62	ness	36
experimentally	29	supercapacitor	34	suboxides	62	multilayer	36
etc	29	plotted	34	rhta	62	jet	36
crucibles	29	nominal	34	mj	62	hdpe	36
ccs	29	nanocomposites	34	magnitude	62	frequencies	36
castables	29	ls	34	isopolytungstate	62	enthalpy	36
bubbles	29	intergranular	34	hm	62	elemental	36
blends	29	impurities	34	germany	62	deflection	36
t	28	gmaw	34	fractional	62	cohesive	36
xl	28	fem	34	foams	62	basalt	36
valence	28	compact	34	ferromanganese	62	antioxidant	36
thermogravimetric	28	biofilm	34	facets	62	δ	35
svm	28	annealed	34	bimodal	62	velocities	35
squeeze	28	ε	33	volatilization	60	tunneling	35
spatial	28	tic	33	usa	60	plot	35
quenching	28	protein	33	unmilled	60	plateau	35
pu	28	optimize	33	potassium	60	orthogonal	35
permittivity	28	na	33	oes	60	mrr	35
niobium	28	ligand	33	micrograph	60	methyl	35
micrographs	28	height	33	microcracks	60	mb	35
mev	28	dense	33	martensitic	60	flux	35
marble	28	cuinse	33	ligament	60	drug	35
localized	28	cspbbr	33	laterite	60	deformations	35
lamellar	28	correlated	33	laboratory	60	damping	35
immersed	28	coarsening	33	iso	60	carboxyl	35
homogeneity	28	beta	33	hf	60	boric	35
ha	28	vec	32	hcp	60	batio	35
gray	28	sio	32	fluid	60	versus	34
filter	28	scan	32	enrichment	60	tendons	34
donor	28	rotational	32	cleavage	60	sisal	34
depolarization	28	rh	32	batch	60	setup	34
cw	28	pilot	32	activated	60	rivet	34
configuration	28	permittivity	32	acidic	60	pmi	34
catalyst	28	neural	32	rs	58	lubrication	34

Appendix 11: (Continued)

cast	28	micrographs	32	rotation	58	irradiation	34
carbides	28	maraging	32	pulp	58	fourier	34
cal	28	japan	32	optimized	58	elium	34
argon	28	germany	32	metalized	58	coli	34
ap	28	fractured	32	mesh	58	cfc	34
annealed	28	experimentally	32	mapping	58	bubble	34
aluminium	28	dissolved	32	gasification	58	brittle	34
activator	28	datasets	32	deposition	58	biopolymer	34
E	27	conductive	32	dense	58	ba	34
vis	27	calcium	32	crystalline	58	anti	34
thermocouples	27	zones	31	compacted	58	ag	34
tetrahedral	27	verify	31	coatings	58	wrt	33
tellurite	27	twin	31	chloride	58	ultrasonic	33
sol	27	turbine	31	cavity	58	simultaneously	33
proton	27	plot	31	batteries	58	silane	33
pa	27	pbbr	31	anodes	58	sba	33
moo	27	nss	31	agglomerates	58	recycling	33
intensities	27	ns	31	aerospace	58	reactivity	33
impregnated	27	nanostructure	31	σ	56	onset	33
fabrication	27	mea	31	wang	56	isoprene	33
eutectoid	27	mated	31	tbc	56	iso	33
emsil	27	ladle	31	susceptibility	56	geometric	33
dioxide	27	intermetallics	31	shap	56	fabricate	33
differential	27	ftir	31	sch	56	deionized	33
dar	27	fc	31	quenching	56	counter	33
conductivities	27	embedded	31	quenched	56	cnsc	33
brittle	27	electrocatalytic	31	oven	56	atomic	33
barrier	27	dta	31	mismatch	56	absorb	33
weibull	26	disintegration	31	liu	56	wettability	32
varistors	26	axial	31	lfm	56	vulcanization	32
tensor	26	σsbcb	30	japan	56	urea	32
substrate	26	throughput	30	ig	56	tetrav	32
saturation	26	tensor	30	gbs	56	tannic	32
resin	26	superalloy	30	fz	56	scavengers	32
residue	26	recrystallized	30	ew	56	resistant	32
reflectance	26	purity	30	consolidated	56	purity	32
pulse	26	precursor	30	characterisation	56	profile	32
plenum	26	penetration	30	automotive	56	pdms	32
plasma	26	oxidative	30	zeiss	54	optimizing	32
photon	26	msc	30	workpiece	54	microfluidic	32
phosphors	26	mismatch	30	vs	54	increment	32
orthorhombic	26	localized	30	tife	54	hybridization	32
optimization	26	laz	30	sulphate	54	hardener	32
nd	26	lath	30	pole	54	filter	32
mgy	26	koh	30	plot	54	ethylene	32
machining	26	ir	30	plies	54	da	32
hydrotalcite	26	gr	30	nitric	54	biocompatibility	32
hydrate	26	gbf	30	metallization	54	axis	32
horizontal	26	dissolution	30	malic	54	alignment	32
harmonic	26	differential	30	fsped	54	ω	31
fuel	26	depicts	30	feasibility	54	recycled	31
ethanol	26	butterfly	30	eqs	54	prs	31
diffuse	26	belite	30	eml	54	pristine	31
diameters	26	bead	30	dissociation	54	node	31
coated	26	barrier	30	counterparts	54	morphologies	31
archimedes	26	au	30	ambient	54	ma	31
alcohol	26	μ	29	alloyed	54	ilss	31
abrasion	26	zabs	29	abrasion	54	hartmann	31
C	25	xco	29	sps	52	eds	31
vitrification	25	volatilization	29	reagents	52	compositions	31
technologies	25	thixotropic	29	pyrite	52	withstand	30
te	25	sded	29	naol	52	wf	30
symmetry	25	resistant	29	mhc	52	usage	30
sieved	25	redox	29	lubricant	52	ti	30
semiconductor	25	reactivity	29	lssvm	52	simulations	30
se	25	negligible	29	inverse	52	scavenging	30

Appendix 11: (Continued)

saturated	25	microscopic	29	diffractometer	52	rves	30
rul	25	micropores	29	conservation	52	radius	30
radial	25	machined	29	braunite	52	pmma	30
percolation	25	leaching	29	anodic	52	morphological	30
nanocomposites	25	iso	29	aligned	52	isotropic	30
multi	25	fractions	29	abundance	52	gfrp	30
metallized	25	forged	29	absorption	52	ft	30
inc	25	equiaxed	29	ω	50	ether	30
hexagonal	25	embrittlement	29	volatile	50	div	30
fluorescence	25	china	29	viscosity	50	combustion	30
feedback	25	castings	29	vector	50	capture	30
fc	25	bilayer	29	twins	50	blend	30
droplets	25	arc	29	thermo	50	atoms	30
dispersed	25	βtf	28	tga	50	alkali	30
crystallographic	25	zhang	28	solvent	50	accelerated	30
coefficients	25	wrought	28	roughing	50	vapor	29
cl	25	wr	28	rotary	50	untreated	29
binary	25	synergistic	28	pyrolusite	50	uneven	29
xrt	24	reversion	28	preheat	50	technologies	29
thermomechanical	24	quartz	28	porosities	50	sd	29
tetrahedra	24	poly	28	petch	50	ni	29
tetragonal	24	platform	28	outlet	50	functionality	29
spikes	24	mocl	28	molecular	50	flakes	29
recombination	24	micropipette	28	limestone	50	experimentally	29
pulsed	24	isothermal	28	ipf	50	electronics	29
pressureless	24	ignition	28	inert	50	ef	29
polytype	24	hydraulic	28	gradient	50	ebc	29
pm	24	htc	28	facet	50	diagram	29
panalytical	24	gan	28	discharge	50	cs	29
od	24	dtx	28	dioxide	50	correlations	29
molecules	24	deionized	28	csd	50	casting	29
mineralogical	24	cp	28	ce	50	attenuation	29
lcc	24	covalent	28	cathode	50	amide	29
kaolin	24	cd	28	buildup	50	absorbing	29
grained	24	ambient	28	bsd	50	abrasive	29
friction	24	algorithms	28	vo	48	virgin	28
chamber	24	aircraft	28	tester	48	tn	28
anode	24	π	27	regolith	48	threshold	28
acceptor	24	κ	27	refractory	48	tem	28
θ	23	un	27	penetration	48	rebound	28
p	23	tife	27	methane	48	prone	28
topology	23	threshold	27	macro	48	polyolefins	28
synthesize	23	technologies	27	ln	48	polyamide	28
soaking	23	ta	27	lamellae	48	patchouli	28
quantitative	23	superalloys	27	gluconic	48	optimize	28
ns	23	solubility	27	filtration	48	nvp	28
nmr	23	radial	27	fabricate	48	module	28
newtonian	23	quasi	27	eaf	48	ion	28
mw	23	multiphase	27	dimensionality	48	fractured	28
metallization	23	mold	27	dcfa	48	flask	28
ligaments	23	mechanochromic	27	counter	48	emission	28
kic	23	mask	27	contamination	48	distilled	28
implanted	23	macroscopic	27	clusters	48	carbonyl	28
fused	23	kw	27	chemistry	48	carbonate	28
fourier	23	imaging	27	breakouts	48	biomass	28
favorable	23	hexagonal	27	biomedical	48	algorithm	28
en	23	flux	27	accelerated	48	δh	27
electrocaloric	23	fluid	27	transverse	46	wavelength	27
distilled	23	fermi	27	textural	46	trans	27
disordered	23	eml	27	solute	46	tissues	27
crystallized	23	eb	27	solidified	46	thermally	27
combustion	23	dosage	27	silicate	46	tester	27
cg	23	dependence	27	resistivity	46	st	27
cements	23	conjugated	27	regression	46	reagent	27
carrier	23	configuration	27	ree	46	profiles	27
carbonates	23	candidate	27	po	46	printer	27

Appendix 11: (Continued)

aluminate	23	bsc	27	mns	46	phr	27
γ	22	adhered	27	middling	46	monomers	27
zeolite	22	xbmh	26	mi	46	linearly	27
xbm	22	verified	26	localized	46	isothermal	27
tib	22	tribological	26	lepidolite	46	functionalized	27
sonochemical	22	tissue	26	kazakhstan	46	extruder	27
semiconductors	22	ruo	26	kam	46	exit	27
sealants	22	ppc	26	isothermal	46	ester	27
schists	22	pmge	26	interior	46	ductile	27
pro	22	perpendicular	26	interfaces	46	diameters	27
platinum	22	nf	26	hip	46	des	27
perpendicular	22	molar	26	herein	46	casson	27
nitride	22	microbe	26	grooves	46	acetonitrile	27
negligible	22	liu	26	flake	46	void	26
nanosecond	22	ionic	26	extractive	46	taguchi	26
molecular	22	grooves	26	defect	46	surrogate	26
mobility	22	droplet	26	capacitors	46	span	26
macroscopic	22	dg	26	beneficiation	46	porous	26
inter	22	desorption	26	arrhenius	46	pollution	26
hydraulic	22	dcnn	26	adhesive	46	para	26
gypsum	22	crystallographic	26	δkth	44	mjf	26
gaseous	22	crucible	26	wo	44	macroscopic	26
fabricated	22	compacted	26	unmelted	44	layout	26
extrusion	22	char	26	twin	44	hydroxide	26
elongated	22	armor	26	transus	44	elevated	26
dispersion	22	anti	26	static	44	electrostatic	26
collagen	22	**e**	25	spectrometry	44	depicts	26
cnn	22	µ	25	spectra	44	banana	26
bioactivity	22	κe	25	shrinkage	44	amine	26
axial	22	virgin	25	ri	44	toxic	25
annihilation	22	versus	25	reactivity	44	rg	25
afe	22	uniaxial	25	propagating	44	reynolds	25
activating	22	ref	25	probe	44	resistivity	25
Q	21	pta	25	plots	44	rebar	25
vickers	21	predictive	25	mmol	44	pyrolysis	25
suspensions	21	patches	25	isostatic	44	plots	25
spike	21	mhc	25	ironmaking	44	hexagonal	25
slurry	21	mesoporous	25	inductively	44	heterogeneous	25
sinter	21	inverse	25	immersed	44	gradient	25
simultaneously	21	interestingly	25	hiped	44	frictional	25
rheological	21	ethanol	25	gears	44	fractures	25
quasi	21	curricula	25	fluorescence	44	feedstock	25
probes	21	cobalt	25	flowsheet	44	electrospinning	25
plug	21	cathode	25	electrowinning	44	doped	25
onset	21	carriers	25	dl	44	dmf	25
nc	21	acidic	25	diagrams	44	dependence	25
naoh	21	e	24	deposit	44	dense	25
naf	21	vhcf	24	debris	44	com	25
molds	21	ultrahigh	24	configuration	44	chamber	25
microcracks	21	surfactant	24	binary	44	ceramics	25
mhz	21	sodium	24	bellows	44	ce	25
jcpds	21	smose	24	ar	44	cbls	25
heterogeneous	21	ru	24	annealing	44	brittleness	25
ghz	21	pva	24	anion	44	boron	25
fluorophlogopite	21	pscs	24	amplitude	44	blending	25
elevated	21	prominent	24	wettability	42	bfs	25
dopants	21	plots	24	vertical	42	aromatic	25
discharge	21	pf	24	st	42	µ	24
dilatometer	21	mesh	24	sigma	42	η	24
cylindrical	21	longitudinal	24	quasi	42	wasp	24
corundum	21	kn	24	qemscan	42	vector	24
capacitance	21	iv	24	pso	42	uncoated	24
blend	21	interstitials	24	prismatic	42	traverse	24
bet	21	interstitial	24	ppm	42	sprayed	24
atm	21	imc	24	plasticity	42	spatial	24

Appendix 11: (Continued)

τf	20	etched	24	pc	42	shrinkage	24
W	20	electroless	24	mullite	42	shpb	24
ρ	20	dsc	24	molasses	42	ptnh	24
ultraviolet	20	dendritic	24	minus	42	ng	24

CURRICULUM VITAE

Bera Taragay KARAOĞLU completed his primary and high school education in Istanbul. He received his BA in English Language and Literature from Karadeniz Technical University. His main areas of interest include corpus linguistics, learner corpora, English for Academic Purposes (EAP), English for Specific Purposes (ESP), and English language teaching. He participated in several online conferences about these topics and received virtual badges and participation certificates.

Bera Taragay KARAOĞLU is single and has a high level of English language proficiency.