

Course Numbering	TME-MSE220J
Year	First semester 2025
Subject (J)	Materials Science and Engineering B
Subject	Materials Science and Engineering B
Credit(s)	2Credits
Instructor	HONGMIN ZHU,TAKAHIRO MIKI,KATSUNARI OIKAWA
Media Class Subjects	
Essential Subjects	
Language of Instruction	English
Course Objectives and Summary/ Learning Goals (J)	<p>Google Classroomのクラスコードは工学部Webページにて確認すること。 学部シラバス・時間割(https://www.eng.tohoku.ac.jp/edu/syllabus-ug.html)</p> <p>1. 目的 金属の製錬プロセスに関する化学熱力学的な基礎を習得し、さらに種々の金属の具体的な製錬法に関する知識を習得することを目的とする。</p> <p>2. 概要 本科目は、短期留学生受け入れプログラムで来日した留学生に対する講義を兼ねているので、英語で講義する。序論においては金属製錬プロセスに関する反応の平衡論を理解させ、各論においては鉄鋼、銅、アルミニウム、その他の金属の製錬法の特徴を理解させて、鉱石からの製錬の流れを講義する。</p> <p>3. 達成目標等 ・本学科の学習・教育目標のA、B、C、D、Kに関する能力を含めて習得する。 ・金属製錬プロセスの基礎となる熱力学的平衡関係を理解し、各種製錬プロセスに関する基礎的知識を習得する。</p>
Course Objectives and Summary/ Learning Goals	<p>The class code for Google Classroom can be found on the Web site of the School of Engineering: https://www.eng.tohoku.ac.jp/edu/syllabus-ug.html (JP Only)</p> <p>Objective This course focus on the principle of chemical thermodynamic of refining process of metals and specific knowledge of each process of various metals.</p> <p>Outline English is used in this class because this course combine with the course for foreign students of short term program. At first, we focus on principle of equilibria of chemical reaction of metal processing, and then refining process of steels, copper, aluminum and other metals to understand the basic procedure and chracteristic</p> <p>Outcomes Understand the thermodynamic equilibrium of metal refining process Understand the basic knowledge of various refining process of metals This course include the contents of our program outcomes of A, B, C, D, K</p>
Relevance to Other Subjects/Considerations for Taking the Class (J)	材料物理化学I、材料物理化学IIを履修していることが望ましい。
Relevance to Other Subjects/Considerations for Taking the Class	Physical chemistry for Materials I, Physical chemistry for Materials II
Course Description (J)	<p>I Thermodynamics for materials processing (K. OIKAWA)</p> <p>1 Introduction of chemical metallurgy 2 Thermodynamic functions and reduction/oxidation equilibrium for materials 3 Ellingham diagram of chemical compounds 4 Prediction of equilibrium oxygen potential at the desired conditions 5 Prediction of heat needed for the given reaction</p> <p>II Pyrometallurgy (T. MIKI)</p> <p>6 Fundamentals of pyrometallurgy 7 Basic principle of iron and steelmaking 8 Iron- and Steelmaking process 9 Basic principle of copper smelting 10 Refining of copper and other metals</p> <p>III Hydrometallurgy and Electrometallurgy (H. ZHU)</p> <p>11 Fundamentals of electrochemistry 12 Hydrometallurgy of zinc and other metals 13 Aluminum smelting</p>

	14 Active metal processing IV Summary 15 Final examination				
Course Description	I Thermodynamics for materials processing (K. OIKAWA) 1 Introduction of chemical metallurgy 2 Thermodynamic functions and reduction/oxidation equilibrium for materials 3 Ellingham diagram of chemical compounds 4 Prediction of equilibrium oxygen potential at the desired conditions 5 Prediction of heat needed for the given reaction II Pyrometallurgy (T. MIKI) 6 Fundamentals of pyrometallurgy 7 Basic principle of iron and steelmaking 8 Iron- and Steelmaking process 9 Basic principle of copper smelting 10 Refining of copper and other metals III Hydrometallurgy and Electrometallurgy (H. ZHU) 11 Fundamentals of electrochemistry 12 Hydrometallurgy of zinc and other metals 13 Aluminum smelting 14 Active metal processing IV Summary 15 Final examination				
Preparation and Review(J)	予習・復習を含めた自習（課題を含む）を行うこと.				
Preparation and Review	Students required to make self-directed learning including review and preparations.				
Evaluation methods and criteria (J)	出席，宿題，定期試験の成績を総合して判定する。(定期試験が行えない場合は，出席やレポートで判定する)				
Evaluation methods and criteria	attendance to the class, home work and final Exam. (attendance to the class and report if the final exam can not be set by the trouble of corona virus)				
Textbooks and references					
Title	Author	Publisher	Year	ISBN/ISSN	Classification
金属化学入門シリーズ 1 金属物理化学	日本金属学会編		1996	4889030115	
金属化学入門シリーズ 3 金属製錬工学	日本金属学会編		1999	4889030123	
Introduction to metallurgical thermodynamic	David R. Gaskell	McGrow-Hill		0070229457	
Principles of Extractive Metallurgy, Vol. 3 Pyrometallurgy	F. Habashi	Gordon and Breach		2881240410	
Aluminium Electrolysis -- Fundamentals of the Hall-Heroult Process	J. Thonstad			3870171294	
URL	材料科学総合学科学習教育到達目標 https://www.material.tohoku.ac.jp/department/purpose.html 材料科学総合学科カリキュラム http://www.material.tohoku.ac.jp/ugrad/curriculum.html				
Attached File					
Office Hours(J)	Any time (Contact the lecture in advance)				
Office Hours	随時（事前に教員に連絡をとること）				
Contact：Please insert '@' in the email address.	クラスルームで連絡可能				

Notes	記号A-Mについては、マテリアル・開発系の教育目標を参照してください。 https://www.material.tohoku.ac.jp/department/purpose.html
Practical Skill/Hands-on Class	
Other Comments/Instructions	
Last Update	2025/3/5

One-credit courses require 45 hours of study. In lecture and exercise-based classes, one credit consists of 15-30 hours of class time and 30-15 hours of preparation and review outside of class. In laboratory, practical skill classes, one credit consists of 30-45 hours of class time and 15-0 hours of preparation and review outside of class.