材料类本科专业培养方案

材料科学与工程学院材料类本科培养方案包括专业类培养特色、专业类面向本科专业、大类课程设置等内容，大类课程设置包括通识教育必修课程、通识教育选修课程和学科基础课程。分专业培养方案包括各专业培养目标、毕业要求和核心课程等内容。专业类专业核心课程、专业拓展课程和课程实践详见分专业培养方案。

一、专业类培养特色

坚持“以学生为中心、成果导向和持续改进”的工程教育理念，坚持“三全育人”的人才培养理念，实施以通识教育为基础的宽口径专业教育，以矿物资源综合利用与环境能源新材料特色创新人才培养为目标，培养“品德优良、基础厚实、知识广博、专业精深”的高素质人才。使学生系统学习材料类基础理论和专业知识，能够熟练使用外语和计算机，具有正确表达、分析和解决材料科学与工程/材料化学/材料物理/新能源材料与器件/矿物加工工程领域复杂工程问题的能力。

二、专业类面向本科专业

学生入学后按材料类厚基础、宽口径培养，修读完共同的通识教育必修课和学科基础课，第五学期开始进入分专业培养阶段。本专业类主要面向的本科专业包括：材料科学与工程、材料化学、材料物理、新能源材料与器件、矿物加工工程。

Undergraduate Program in Materials

The undergraduate program of materials in the School of Materials Science and Technology includes the major characteristics, for undergraduate majors, and courses in general major. The courses of general major involve Required Courses of General Education, Selective Courses of General Education and Disciplinary Fundamental Courses. The undergraduate program includes academic objectives, academic requirements and core courses of each major. Regarding to the Specialized Core Courses, Specialized Development Courses and Course Practice, please refer to the training plan of different majors.

1. Characteristics of General Major

Adhere to the engineering education concept of "student-centered, achievement-oriented and continuous improvement" and adhere to the talents training concept of "three-dimensional education". Implement wide-caliber professional education based on general education. Taking comprehensive utilization of mineral resources and new materials of environment and energy as the academic objectives, it aims to cultivate high-quality and innovative talents with good moral character, solid foundation, extensive knowledge and profound specialty. To enable students to systematically study the basic theories and professional knowledge of materials, use foreign languages and computers proficiently, and have abilities to correctly express, analyze and solve complex engineering problems in the fields of Materials Science and Engineering/ Materials Chemistry/ Materials Physics/ New Energy Materials and Devices/ Mineral Processing Engineering.

2. Category for Undergraduate Majors

After enrollment, students are trained according to the material category of thick foundation and wide caliber. After finishing the Required Courses of General Education and Disciplinary Fundamental Courses, students will enter the stage of professional training in the fifth semester. Undergraduate majors for this major include: Materials Science and Engineering, Materials Physics, Materials Chemistry, New Energy Materials and Devices, Mineral Processing Engineering.

三、大类课程 (Courses of General Major)

1、通识教育必修课程 (Required Courses of General Education)：682 学时 (682Hours)，38 学分 (38Credits)

课程代码 Code	课程名称 Courses Name	总学时 Hours	学分 Credits	讲课 学时 Lec.	实验 学时 Exp.	线上 学时 Online	考核方式 Assessment	开课学期 Semester	备注 Notes
GR181009	思想道德与法治 Ideological Morality and Rule of Law	48	3	40	8		考试 Exam	1	
GR181008	中国近现代史纲要 Essentials of Modern Chinese History	48	3	40	8		考试 Exam	2	
GR182014	马克思主义基本原理 Fundamental Principles of Marxism	48	3	40	8		考试 Exam	3	
GR182024	毛泽东思想和中国特色社会主义理论体系概论 Introduction to Mao Zedong Thoughts and Theoretical System of the Chinese Characteristic Socialism	32	2	32			考试 Exam	4	
GR182022	习近平新时代中国特色社会主义思想概论 Introduction to Xi Jinping Thoughts on Socialism with Chinese Characteristics in the New Era	48	3	48			考试 Exam	5	
GR181013	形势与政策（1） Situation and Policy（1）	4	0.25	4			考查 Term paper	1	
GR181014	形势与政策（2） Situation and Policy（2）	4	0.25	4			考查 Term paper	2	
GR181015	形势与政策（3） Situation and Policy（3）	4	0.25	4			考查 Term paper	3	
GR181016	形势与政策（4） Situation and Policy（4）	4	0.25	4			考查 Term paper	4	
GR181017	形势与政策（5） Situation and Policy（5）	4	0.25	4			考查 Term paper	5	

课程代码 Code	课程名称 Courses Name	总学时 Hours	学分 Credits	讲课 学时 Lec.	实验 学时 Exp.	线上 学时 Online	考核方式 Assessment	开课学期 Semester	备注 Notes
GR181018	形势与政策（6） Situation and Policy（6）	4	0.25	4			考查 Term paper	6	
GR181019	形势与政策（7） Situation and Policy（7）	4	0.25	4			考查 Term paper	7	
GR181020	形势与政策（8） Situation and Policy（8）	4	0.25	4			考查 Term paper	8	
GR301004	大学生职业生涯规划与就业指导（1） Career Planning and Employment Guidance for University Students (1)	20	1	16	4		考试 Exam	2	
GR303005	大学生职业生涯规划与就业指导（2） Career Planning and Employment Guidance for University Students (2)	18	1	12	6		考试 Exam	6	
GR301005	大学生心理素质教育（1） Mental Health (1)	16	1	16	0		考查 Term Paper	1	
GR303005	大学生心理素质教育（2） Mental Health (2)	16	1	16	0		考查 Term Paper	5	
GR301024	劳动教育与双创实践(1)Labor Education and Innovation and Entrepreneurship Practice(1)	16	1	16			考查 Term Paper	2	
GR303025	劳动教育与双创实践(2)Labor Education and Innovation and Entrepreneurship Practice(2)	16	1	16			考查 Term Paper	6	
GR311601	军事理论 Military Theory	36	2	36	0		考试 Exam	1	
GR081071	大学英语（1） College English (1)	64	4	64			考试 Exam	1	
GR081072	大学英语 （2） College English (2)	32	2	32			考试 Exam	2	
GR081067	大学英语素质拓展课	32	2	32			考试 Exam	2	

课程代码 Code	课程名称 Courses Name	总学时 Hours	学分 Credits	讲课 学时 Lec.	实验 学时 Exp.	线上 学时 Online	考核方式 Assessment	开课学期 Semester	备注 Notes
	Competence-oriented Education for College English								
GR141005	体育（1）（系列课程） Physical Education (1)(series of courses)	32	1		32		考试 Exam	1	
GR141006	体育（2）（系列课程） Physical Education (2) (series of courses)	32	1		32		考试 Exam	2	
GR142007	体育（3）（系列课程） Physical Education (3) (series of courses)	32	1		32		考试 Exam	3	
GR142008	体育（4）（系列课程） Physical Education (4) (series of courses)	32	1		32		考试 Exam	4	
GR041011	人工智能概论 Introduction of Artificial Intelligence	32	2		32		考试 Exam	1	
总计 Total		682	38	488	194				

2、**通识教育选修课程**（Selective Courses of General Education）：160 **学时**(160hours)，10 **学分**(10 Credits)

序号 No.	课程类别 Courses Classification	课程名称 Courses Name	学分 Credits	考核方式 Assessment	开课学期 Semester	备注 Notes
1	人文社科类（含在线课程） Humanities and Social Sciences Courses (Inc. Online Courses)	见附件 1	6	考查 Term paper	2-8	5 个类别中选修 6 个学分， 其中国家安全教育 1 学分、新生研讨课 1 学分均为必选， 其他合计 4 学分。
2	自然科学类（含在线课程） Natural Science Courses (Inc. Online Courses)	见附件 2		考查 Term paper	2-8	

3	生态文明类（自然文化、碳中和） Ecological Civilization Courses(Natural Culture、Carbon-Neutral)	见附件 3		考查 Term paper	2-8	
4	体育与健康类 Sports and Health Courses	见附件 4		考查 Term paper	2-8	
5	新生研讨课程 Freshman Seminar	见附件 5		考查 Term paper	1-2	
6	创新创业教育类（含在线课程） Innovation and Entrepreneurship Courses (Inc. Online Courses)	见附件 6	2	考查 Term paper	2-8	
7	审美与艺术类 Aesthetics and Art Courses	见附件 7	2	考查 Term paper	2-8	
总计 Total			10			

3、**学科基础课程** (Disciplinary Fundamental Courses）：576 **学时**(576Hours)，36 **学分**(36Credits)

课程代码 Course Code	课程名称 Courses Name	学时 Hours	学分 Credits	讲课学时 Lec.	实验学时 Exp.	线上学时 Online	考核方式 Assessment	开课学期 Semester	备注 Notes
DR030041	材料类专业导论 Introduction to Materials Major	16	1	16			考试 Exam	1	
DR031601	材料实验与实践安全 Experiment and practice safety	16	1	16			考试 Exam	1	
DR191001	高等数学 A（1） Advanced Mathematics A（1）	96	6	96			考试 Exam	1	

课程代码 Course Code	课程名称 Courses Name	学时 Hours	学分 Credits	讲课学时 Lec.	实验学时 Exp.	线上学时 Online	考核方式 Assessment	开课学期 Semester	备注 Notes
DR191002	高等数学 A（2） Advanced Mathematics A（2）	96	6	96			考试 Exam	2	
DR192605	线性代数 A Linear Algebra A	40	2.5	40			考试 Exam	3	
DR192607	概率论 Probability	32	2	32			考试 Exam	4	
DR191608	大学物理 B（1） College Physics B (1)	48	3	48			考试 Exam	2	
DR192609	大学物理 B（2） College Physics B (2)	48	3	48			考试 Exam	3	
DR021002	工程图学 Engineering Graphics	48	3	48			考试 Exam	1	
DR191612	无机化学 A Inorganic Chemistry A	48	3	48			考试 Exam	1	
DR192015	有机化学 C Organic Chemistry C	40	2.5	40			考试 Exam	3	
DR192017	物理化学 B Physical Chemistry B	48	3	48			考试 Exam	3	
总计 Total		576	36	576					

4、专业核心课程（材料类课程部分）（Specialized Core Courses）：208 学时(208 hours)，13 学分(13Credits)

课程代码 Course Code	课程名称 Courses Name	学时 Hours	学分 Credits	讲课学时 Lec.	实验学时 Exp.	线上学时 Online	考核方式 Assessment	开课学期 Semester	备注 Notes
SR032612	晶体学基础 Fundamentals of crystallography	32	2	32			考试 Exam	3	
SR032603	工业矿物与岩石 Industrial Minerals and Rocks	40	2.5	40			考试 Exam	4	
DR033002	材料科学基础 Fundamentals of Materials Science	48	3	48			考试 Exam	4	
SR032613	材料现代测试技术 Modern Techniques for Materials Characterization	24	1.5	24			考试 Exam	4	
DR033103	材料力学基础 Fundamentals of Material Mechanics	32	2	32			考试 Exam	4	
SR032604	电路与器件原理 Principles of Circuits and Devices	32	2	32			考试 Exam	4	
总计 Total		208	13	208					

5. 课程实践（Course Practice）：4 周+152 学时 (4 Weeks and152 Hours)，11 学分 (11 Credits)

课程代码 Courses Code	课程名称 Courses Name	周（学时） Weeks（hours）	学分 Credits	考核方式 Assessment	开课学期 Semester	备注 Notes
PR311602	军事技能训练 Military Theory and Practice	2 周	2	考查 Term Paper	1	

课程代码 Courses Code	课程名称 Courses Name	周（学时） Weeks（hours）	学分 Credits	考核方式 Assessment	开课学期 Semester	备注 Notes
PR181010	思想政治社会实践 Political Social Practice	32 学时	2	考查 Term paper	1 夏	
PR191045	实验物理（1） Physics Experiments (1)	24 学时	1	考试 Exam	2	
PR192046	实验物理（2） Physics Experiments (2)	24 学时	1	考试 Exam	3	
PR191047	实验化学 Chemistry Experiments	48 学时	2	考试 Exam	2	
PR032655	晶体学基础实验 Fundamental Experiments of Crystallography	1 周	1	考查 Term paper	3	
PR032656	材料现代测试技术实验 Modern Techniques for Materials Characterization Experiments	1 周	1	考查 Term paper	4	
PR032117	晶体光学 Crystal Optics Experiments	24 学时	1	考试 Exam	4	
总计 Total			11			

材料科学与工程专业本科培养方案

Undergraduate Program in Materials Science and Engineering

一、专业简介（Major Introduction）

材料科学与工程是一门研究材料的成分、结构、合成加工、性能与应用之间关系的工学学科，致力于培养能在材料相关领域从事基础研究、技术开发与生产管理的高级专门人才。本专业依托自 1952 年逐步建立的实验岩石学、应用矿物学、矿物晶体结构与晶体化学等学科方向而发展壮大。1993 年成立材料科学系，1995 年开始按“无机非金属材料”专业招收本科生，1999 年调整为材料科学与工程学院并按“材料科学与工程”专业招收本科生，2005 年获评校级品牌专业，2010 年入选国家级特色专业，2021 年入选国家级一流本科专业建设点。

二、专业培养目标（Academic Objectives）

本专业面向国家战略需求，适应材料科学与工程未来发展方向，德智体美劳全面发展，掌握材料科学与工程专业的基本理论、基本方法和基本技能，得到材料工程师基本训练，能够胜任无机非金属材料、矿物新材料及工业固废与资源循环利用相关领域的技术、管理和研究开发工作，具有较强的实践和创新创业能力，具备一定的国际视野和可持续发展潜力，“品德优良、基础厚实、知识广博、专业精深”的材料科学与工程一流拔尖创新人才。

经过五年左右的实践，应达到以下目标：

1）恪守工程行业职业道德与社会伦理，依托自身专业能力对接产业、国家发展需求，主动履行行业从业者的社会责任，保持良好职业操守。

2）可在矿物资源资源化利用、工业固废处置、矿物加工、陶瓷与耐火材料等细分领域，独立开展工程设计、技术开发、生产运维、项目管理相关工作，达到合格材料工程师的岗位从业要求。

3）具备良好跨团队协作、跨文化沟通、科学决策能力，可担任项目骨干，具备牵头小型技术团队、承担局部管理工作的发展潜力。

4）拥有持续自主学习、工程创新的能力，能够独立或协作开展无机非金属、矿物材料方向的技术改良、应用研究类科研工作，适配产业技术迭代需求。

5）依托岗位实践逐步积累工程管理经验，成长为相关企事业单位的核心技术骨干或是技术管理人员。

三、毕业要求（Graduation Requirement）

掌握材料科学与工程领域的基本理论与技术，具备矿物与无机非金属材料及其复合材料科学与工程领域的扎实基础，具有较强的实践动手能力，以广泛适应材料科学与工程及其相关领域的要求。

毕业生应获得以下几个方面的知识和能力：

1）工程知识：能够将数学、自然科学、计算、工程基础和专业知识用于解决矿物及无机非金属材料相关的复杂工程问题。

2）问题分析：能够应用数学、自然科学和工程科学的基本原理，识别、表达矿物及无机非金属材料领域的复杂工程问题，结合文献调研开展分析，综合考量可持续发展约束条件，推导获得有效结论。

3）设计/开发解决方案：能够针对矿物及无机非金属材料相关复杂工程问题，设计开发对应的解决方案、系统单元或工艺流程；在设计环节融入创新意识，综合考量社会、健康、安全、法律、文化、环境、全生命周期成本、净零碳排放等约束因素。

4）研究：能够基于科学原理并采用科学方法对矿物及无机非金属材料相关复杂工程问题开展研究，完成实验方案设计、数据采集、分析与解释，结合多源信息综合研判，最终得到合理可靠的结论。

5）使用现代工具：能够针对矿物及无机非金属材料领域复杂工程问题，选用、适配现代

工程工具与信息技术工具开展计算、预测和模拟，依托工具辅助完成工程分析；同时明晰各类工具的适用范围与固有局限性，审慎校验工具输出结果以支撑工程决策。

6）工程与可持续发展：在解决矿物及无机非金属材料复杂工程问题时，能够依托工程背景知识，分析、评价工程实践对于健康、安全、环境、法律、经济、社会层面的长期影响，对标可持续发展目标研判方案可行性，充分理解自身需要承担的工程社会责任。

7）工程伦理和职业规范：树立工程报国、为民造福的价值理念，具备人文社会科学素养与社会责任感；能够辨识工程活动涉及的多方利益诉求，理解并践行工程伦理准则，在工程实践中严格遵守工程职业规范、相关法律法规，主动履行职业与社会责任。

8）个人和团队：能够参与多学科背景下的工程团队，胜任普通团队成员、分项负责人等不同角色，协同完成矿物及无机非金属材料领域各类工程任务。

9）沟通：能够围绕矿物及无机非金属材料相关工程问题，和行业从业者、社会公众开展高效沟通交流；具备撰写技术报告、学术论文、参与学术交流的基础能力，拥有一定国际视野，熟练运用一门外语，可完成跨文化场景下的专业沟通协作。

10）项目管理：理解并掌握工程项目管理原理、经济决策方法，可将相关方法应用于多学科协作的矿物及无机非金属材料工程项目当中，统筹管控项目成本、进度与技术风险。

11）终身学习：具备自主学习、终身学习以及批判性思维的意识，能够主动跟踪材料行业技术变革与产业发展趋势，持续更新知识体系，适配行业长期发展带来的能力升级需求。

四、主干学科（Main disciplines）

材料科学与工程。

五、学制与学位（Length of Schooling and Degree）

学制四年。学生修满规定的最低毕业学分，达到毕业要求后，授予工学学士学位。

六、核心课程（Core Courses）

专业核心课程：材料科学基础、材料工程基础、晶体学基础、量子力学、材料力学基础、材料物理、电路与器件原理、工业矿物与岩石、材料现代测试技术、无机材料工艺与生产设备、人工智能与材料基因工程、矿物材料学、工业技术经济与工程伦理、材料专业英语与科技写作、材料工厂设计与智能化制造概论和材料实验与实践安全等。

实践课程：实验物理、实验化学、晶体光学、金工实习、教学实习、专业实习、材料基础实验、材料专业综合设计实验和毕业论文等。

Undergraduate Program in Materials Science and Engineering

1. Major Introduction

Materials Science and Engineering is all about studying how a material's composition, structure, processing, properties, and applications are connected. The goal is to train top-notch people who can dive into research, tech development, and production management in material-related fields. Our program grew thanks to our university's efforts since 1952 in areas like experimental petrology, applied mineralogy, and crystal chemistry. The Materials Science Department kicked off in 1993, started taking undergrads for the 'Inorganic Non-metallic Materials' program in 1995, and got renamed the School of Materials Science and Engineering in 1999, offering undergrad courses in 'Materials Science and Engineering'. It got recognized as a university flagship program in 2005, became a national featured program in 2010, and in 2021, it was picked as a national first-class undergraduate program.

2. Academic Objectives

Facing the national strategic needs, adapting to the future development direction of materials science and engineering, with comprehensive development in morals, intelligence, sports, aesthetics, and labour education, mastering the basic theories, methods and skills of materials science and engineering, obtaining basic training for material engineers, be competent in the technology, management, research, and development of inorganic non-metallic materials, new mineral materials and industrial solid waste and resource recycling even other related fields, with strong practical and innovative entrepreneurial capabilities, with a certain international vision and sustainable development potential, the first-class innovative talents in materials science and engineering with the characteristics of "excellent moral character, solid foundation, broad knowledge and profound professionalism".

After about five years of practice, the following goals should be achieved:

1) Have good moral cultivation and humanities and social science literacy, good engineering professional ethics and norms, strong sense of social responsibility and professionalism, based on their own knowledge and ability, and be willing to serve the country and society, able to undertake and fulfill social responsibilities;

2) Be able to engage in the design and implementation of material science and engineering, technology development, engineering management and other work in the fields of mineral resources and industrial solid waste utilization, mineral processing, ceramics and refractories, and be competent for the work of material engineers;

3) Have a strong sense of teamwork, international vision, and the abilities of communication, reasonable decision-making and organizational management, also be able to work as a leader in the team;

4) be able to innovate, update knowledge continuously in time and undertake scientific research related to minerals and inorganic non-metallic materials independently or collaboratively;

5) Have good professional quality, rich engineering management experience and the ability to adapt to the development of the industry, and become a technical backbone or management talent in enterprises and institutions related to mineral and inorganic non-metallic materials.

3. Graduation Requirements

Based on materials science, chemistry and physics, the major of materials science and engineering systematically studies the basic theory and practical skills of materials science and engineering and applies them to the synthesis, preparation and performance optimization of materials. Students of this major need to master the basic theory and technology in the field of materials science and engineering, have a solid foundation in the field of mineral and inorganic non-metallic materials and their composite materials science and engineering and have a strong practical ability to widely adapt to the requirements of materials science and engineering and related fields.

The graduates should obtain the following knowledge and ability:

1) Engineering knowledge: be able to apply mathematics, natural science, engineering foundation and professional knowledge to solve practical engineering problems related to material

physics.

2) Problem analysis: be able to apply the basic principles of mathematics, natural science and engineering science, combined with literature research, to analyze practical engineering problems related to material physics, and obtain effective conclusions.

3) Design/develop solutions: be able to design solutions for practical engineering problems related to material physics, and be innovative and take social, health, safety, legal, cultural and environmental factors into consideration.

4) Research: be able to conduct research on practical engineering problems related to material physics based on scientific principles via using scientific methods, and finally get reasonable and effective conclusions through designing experiments, analyzing and interpreting data.

5) Use modern tools: be able to master certain modern engineering tools and information technology tools, and could solve practical engineering problems related to material physics.

6) Engineering and sustainable development: be able to conduct reasonable analysis based on engineering-related background knowledge when solving complex engineering problems related to mineral materials and inorganic non-metallic materials, evaluate the impact of engineering practice on health, safety, environment, law, economy, and social sustainable development, and understand the responsibilities to be assumed.

7) Engineering Ethics and Professional Norms: have the awareness of serving the country through engineering and benefiting the people, as well as humanistic and social science literacy and social responsibility. Be able to understand and practice engineering ethics, abide by engineering professional ethics, norms, and relevant laws in engineering practice, and fulfill corresponding responsibilities.

8) Individuals and Teams: be capable of acting as individuals, team members and leaders in a multidisciplinary team.

9) Communication: be able to effectively communicate with peers and the public on engineering issues related to material physics, including the basic ability to write reports (papers) and participate in academic exchanges; have a certain international vision, master a foreign language, can communicate under the cross-cultural background.

10) Project Management: be able to understand and master engineering management principles and economic decision-making methods, and apply them in a multidisciplinary environment.

11) Lifelong learning: have the consciousness of independent learning and lifelong learning, and have the ability to continuously learn and adapt to development.

4. Main disciplines

Materials science and Engineering.

5. Length of Schooling and Degree

The length of schooling is four years of full-time study. Students will be awarded the Bachelor Degree of Engineering when they have completed the required minimum credits and have met all other requirements.

6. Core Courses

Core Professional Courses: Fundamentals of Materials Science, Fundamentals of Materials Engineering, Fundamentals of Crystallography, Quantum Mechanics, Fundamentals of Mechanics of Materials, Materials Physics, Principles of Circuits and Devices, Industrial Minerals and Rocks, Modern Materials Characterization Techniques, Inorganic Materials Technology, Artificial Intelligence and Materials Genome Engineering, Mineral Materials, Industrial Technology Economics and Engineering Ethics, Professional English for Materials Science and Scientific Writing, Introduction to Materials Plant Design and Intelligent Manufacturing, Materials Experimentation and Practical Safety, etc.

Practical Courses: Experimental Physics, Experimental Chemistry, Crystal Optics, Metalworking Practice, Teaching Practice, Professional Internship, Basic Materials Experiments, Comprehensive Design Experiments for Materials Science, Graduation Thesis, etc.

六、最低毕业总学分要求及学分分配（Minimum Required Credits and Distribution）

课程模块 Courses Module	课程类别 Course Classification	学时数 Hours	学分 Credits	学 期 Semester										
				1	2	1 夏	3	4	2 夏	5	6	3 夏	7	8
通识教育 Liberal Education	通识教育必修课程 Required Courses of General Education	682	38	13.25	10.25		4.25	3.25		4.25	2.25		0.25	0.25
	通识教育选修课程 Selective Courses of General Education	160	10											
专业教育 Professional Education	学科基础课程 Disciplinary Fundamental Courses	576	36	14	9		11	2						
	专业核心课程 Specialized Fundamental Courses	480	30				2	11		10	4		3	
	专业模块课程（选修 1 个模块） Specialized Development	96	6							1.5/2	4.5/4			
实践教育 Practical Education	课程实践 Course Practice	31 周+248 学时	36	2	3	2	2	2	5	2	2	6	4	6
	课外实践 Extracurricular practice		6											
必修课总学分 Required course credits				140										
选修课总学分 Elective course credits				22										
最低毕业总学分 Total Credits				162										

七、分专业课程设置（Curriculum）

1、专业核心课程（Specialized Core Courses）：272 学时(272 hours)，17 学分(17Credits)

课程代码 Course Code	课程名称 Courses Name	学时 Hours	学分 Credits	讲课学时 Lec.	实验学时 Exp.	线上学时 Online	考核方式 Assessment	开课学期 Semester	备注 Notes
SR033605	材料物理 B Materials Physics B	32	2	24	8		考试 Exam	5	
SR033606	材料工程基础 A Fundamentals of Materials Engineering A	32	2	32			考试 Exam	5	
SR033624	量子力学 Quantum Mechanics	32	2	32			考试 Exam	5	
SR033607	无机材料工艺与生产设备 Inorganic Materials Technology and Equipment	32	2	32			考试 Exam	5	
SR033608	矿物材料学 Mineral Materials	32	2	32			考试 Exam	5	
SR033609	人工智能与材料基因工程 Artificial Intelligence and Materials Genome Engineering	32	2	20	12		考试 Exam	6	
SR033106	材料工厂设计与智能化制造概论 Introduction to design of production plant and intelligent manufacturing in materials	32	2	32			考试 Exam	6	
SR034610	工业技术经济与工程伦理 Industrial Technical Economics and Engineering Ethics	32	2	32			考试 Exam	7	
SR034611	材料专业英语与科技写作 Specialized English and Writing for Materials Science	16	1	16			考试 Exam	7	

课程代码 Course Code	课程名称 Courses Name	学时 Hours	学分 Credits	讲课学时 Lec.	实验学时 Exp.	线上学时 Online	考核方式 Assessment	开课学期 Semester	备注 Notes
总计 Total		272	17	252	20				

2、专业模块课程（Specialized Development Courses）：选修 1 个模块，96 学时(96hours)，6 学分(6Credits)

课程代码 Course Code		课程名称 Courses Name	学时 Hours	学分 Credits	讲课学时 Lec.	实验学时 Exp.	线上学时 Online	考核方式 Assessment	开课学期 Semester	备注 Notes
SS033632	**模块 1 先进矿物与结构材料**	资源循环与材料化利用 Resource Recycling and Material Utilization	24	1.5	24			考试 Exam	5	
SS033633		先进结构材料与设计 Advanced Structural Materials and Design	40	2.5	40			考试 Exam	6	
SS033634		材料失效与有限元分析 Materials Failure and Finite Element Analysis	32	2	32			考试 Exam	6	
SS033635	**模块 2 先进功能材料**	电介质物理与功能材料 Dielectric Physics and Functional Materials	32	2	32			考试 Exam	5	
SS033636		先进碳材料 Advanced Carbon Materials	32	2	32			考试 Exam	6	
SS033637		新能源材料化学 New Energy Materials Chemistry	32	2	32			考试 Exam	6	

3、课程实践（Course Practice）：31 周+248 学时 (31 Weeks and 248 Hours)，36 学分 (36 Credits)

课程代码 Courses Code	课程名称 Courses Name	周（学时） Weeks（hours）	学分 Credits	考核方式 Assessment	开课学期 Semester	备注 Notes
PR311602	军事技能训练 Military Theory and Practice	2 周	2	考查 Term Paper	1	
PR181010	思想政治社会实践 Political Social Practice	32 学时	2	考查 Term paper	1 夏	
PR191045	实验物理（1） Physics Experiments (1)	24 学时	1	考试 Exam	2	
PR191046	实验物理（2） Physics Experiments (2)	24 学时	1	考试 Exam	3	
PR191047	实验化学 Chemistry Experiments	48 学时	2	考试 Exam	2	
PR032655	晶体学基础实验 Fundamental Experiments of Crystallography	1 周	1	考查 Term paper	3	
PR032656	材料现代测试技术实验 Modern Techniques for Materials Characterization Experiments	1 周	1	考查 Term paper	4	
PR032117	晶体光学 Crystal Optics Experiments	24 学时	1	考试 Exam	4	
PR033653	材料基础实验 (1) Fundamental Experiments of Materials (1)	48 学时	2	考查 Term paper	5	
PR033654	材料基础实验 (2) Fundamental Experiments of Materials (2)	48 学时	2	考查 Term paper	6	

课程代码 Courses Code	课程名称 Courses Name	周（学时） Weeks（hours）	学分 Credits	考核方式 Assessment	开课学期 Semester	备注 Notes
PR034116	材料专业综合设计实验 Special Comprehensive Experiments	4 周	4	考查 Term paper	7	
PR022099	金工实习 Metalworking Practice	1 周	1	考查 Term paper	2 夏	
PR032039	教学实习 Teaching Practice	4 周	4	考查 Term paper	2 夏	
PR033040	专业实习 Professional Practice	6 周	6	考查 Term paper	3 夏	
PR034043	毕业设计（论文） Graduation Design (Thesis)	12 周	6	考查 Term Paper	8	
总计 Total		31 周+248 学时	36			

4、课外实践（Extracurricular practice）：6 学分（6 Credits）

包括主题教育活动、社会实践、志愿服务、勤工助学、学科竞赛、文体活动、创新创业活动、劳动实践等，其学分的认定按照教务处相关规定执行。

Extracurricular practice include Theme Education, Social Practice, Volunteer Service, Work-study Program, Discipline Competition, Cultural and Sports Activities, Innovative and Entrepreneurial Activities, Labor Practice and so on. The recognition of the credits for innovcation and entrepreneurship shall be implemented according to the regulations of Academic Affairs Office.

八、毕业要求与培养目标矩阵（工程教育认证类专业）

毕业要求	培养目标				
	目标 1	目标 2	目标 3	目标 4	目标 5
毕业要求1		√			
毕业要求2		√			
毕业要求3		√		√	
毕业要求4		√		√	
毕业要求5		√			
毕业要求6	√				
毕业要求7	√				
毕业要求8	√				√
毕业要求9			√		
毕业要求10			√		
毕业要求11					√

在相应的毕业要求与培养目标里划 √

九、课程与毕业要求关系矩阵（工程教育认证专业类专业参考）

毕业要求 / 课程名称	(1) 工程知识	(2) 问题分析	(3) 设计/开发解决方案	(4) 研究	(5) 使用现代工具	(6) 工程与可持续发展	(7) 工程伦理和职业规范	(8) 个人和团队	(9) 沟通	(10) 项目管理	(11) 终身学习
思想道德与法治							L				
中国近现代史纲要											L
马克思主义基本原理							L				
毛泽东思想和中国特色社会主义理论体系概论							L				
习近平新时代中国特色社会主义思想概论							L				
形势与政策						L	L				
大学生职业生涯规划与就业指导Ⅰ、Ⅱ							M				
大学生心理素质教育 1,2								L			
大学英语 1,2									L		
大学英语素质拓展课									L		
体育 1,2,3,4								L	L		L
人工智能概论					L						
高等数学 A 1,2	L										
线性代数 A	L										
概率论	L										
大学物理 B 1,2	L										
工程图学	H										
无机化学	L										
有机化学 C	L										
物理化学 B	L										

毕业要求 课程名称	(1) 工程知识	(2) 问题分析	(3) 设计/开发解决方案	(4) 研究	(5) 使用现代工具	(6) 工程与可持续发展	(7) 工程伦理和职业规范	(8) 个人和团队	(9) 沟通	(10) 项目管理	(11) 终身学习
材料类专业导论											H
晶体学基础	M	M									
工业矿物与岩石	M	H									
材料科学基础	M	H				M					
矿物材料学		M				M					
量子力学	L										
材料现代测试技术				L	H						
材料力学基础	M	M		L		M					
电路与器件原理				L	L						
材料物理 B	M	M									
材料工程基础 A	H		M								
无机材料工艺与生产设备		L	M			H					
人工智能与材料基因工程				M	H						
材料工厂设计与智能化制造概论			M			M					
工业技术经济与工程伦理						H				H	
先进结构材料与设计	M		M								
电介质物理与功能材料	M		M								
材料失效与有限元分析		M									
新能源材料化学		M									
资源循环与材料化利用			M								
先进碳材料			M								
材料专业英语与科技写作									M		

毕业要求 课程名称	(1) 工程知识	(2) 问题分析	(3) 设计/开发解决方案	(4) 研究	(5) 使用现代工具	(6) 工程与可持续发展	(7) 工程伦理和职业规范	(8) 个人和团队	(9) 沟通	(10) 项目管理	(11) 终身学习
军事理论、军事技能训练								M			
思想政治社会实践								M			
实验物理 1,2					L						
实验化学					L						
材料实验与实践安全							H				
材料现代测试技术实验					M						
晶体学基础实验					M						
晶体光学					M						
材料基础实验 1,2				M	M			M			M
材料专业综合设计实验		L	H	M	M			H	M		
金工实习						L					
教学实习			M			M					
专业实习						M				M	
毕业设计（论文）			H		H				H	H	

材料化学专业本科培养方案

Undergraduate Program in Materials Science and Engineering

一、专业简介（Major Introduction）

材料化学系源于 1995 年成立的化学教研室，于 2006 年从化学教研室分出，成立材料化学教研室，依托中国地质大学（北京）矿物资源利用优势，现形成了以矿物/高分子复合材料为专业特色，以新材料的研发和应用为目标，培养学生德、智、体、美、劳全面发展的特色专业。经过多年积累，现已建成了一支由国家级人才组成的专业教师队伍，形成矿物材料、矿物复合材料、新能源材料、生物医用材料、环境材料等研究方向，专业于 2022 年获批北京市一流专业建设。

二、专业培养目标（Academic Objectives）

材料化学专业面向国家对新材料、新工艺、新技术等方面的战略需求，使学生系统学习高分子材料及矿物复合材料的专业知识和实验操作技能，并将其应用于材料的设计、合成、制备、加工等方面。培养学生具有良好的职业道德、社会责任感、可持续发展意识和终身学习能力。形成在新材料、能源、环境、化工等领域的复合型人才。经过五年的实际工作，能够承担与材料化学或复合材料相关的研究、工程设计、技术开发、产品生产、经营管理等工作，以及在高等院校从事本专业相关的教学科研工作。 具体为：

（1）身心健康、品德优良、具有良好的职业道德、社会责任感，具有创新素质，了解国家关于材料科学领域发展的方针、政策和法规，具有高度的安全意识、环保意识和可持续发展意识。

（2）具有从事材料化学和矿物/高分子复合材料领域科学研究、工程设计和技术服务等工作所需的基础知识、专业知识和其他相关科学知识，具有较强的创新能力，能有效地进行新材料、新工艺、新技术的探索、开发和应用，满足新形式下对工程师的要求。

（3）具有良好的口头、书面表达和交流沟通能力，具有组织能力和较强的团队合作精神，具备牵头小型技术团队、承担局部管理工作的发展潜力。

（4）拥有持续自主学习、工程创新的能力，能够独立或协作开展高分子材料、矿物材料、矿物复合材料方向的技术改进、应用研究类科研工作，适配产业技术迭代需求。

（5）具有良好的专业素养、一定的工程管理经验和适应行业发展的能力，成为高分子及其复合材料及相关领域技术骨干或管理人才。

三、毕业要求（Graduation Requirement）

材料化学专业学生应掌握材料化学的基本理论与技术，具备矿物及其高分子复合材料科学与工程领域的扎实基础，具有较强的实践动手能力，以广泛适应材料科学相关领域的要求。毕业生应该获得以下几方面的知识和能力：

（1）工程知识：能够将数学、自然科学、工程基础和专业知识用于解决相关的工程实际问题。

（2）问题分析：能够应用数学、自然科学和工程科学的基本原理，结合文献研究，分析材料学科相关的工程实际问题，以获得有效结论。

（3）设计 / 开发解决方案：能够设计针对材料化学和矿物及其高分子复合材料相关工程实际问题的解决方案，并能够在设计环节中体现创新意识，考虑社会、健康、安全、法律、文化以及环 境等因素。

（4）研究：能够基于科学原理并采用科学方法对材料化学和矿物及其高分子复合材料相关工程实际问题进行研究，通过设计实验、分析与解释数据，最终得到合理有效的结论。

（5）使用现代工具：能够掌握一定的现代工程工具和信息技术工具，并用以辅助解决材料学与材料化学相关实际工程问题。

（6）工程与可持续发展：在解决复合材料相关复杂工程问题时，能够基于工程相关背

景知识，分析和评价工程实践对健康、安全、环境、法律以及经济和社会可持续发展的影响，并理解应承担的责任。

（7） 工程伦理和职业规范：有工程报国、为民造福的意识，具有人文社会科学素养和社会责任感，能够理解和践行工程伦理，在工程实践中遵守工程职业道德、规范和相关法律，履行责任。

（8）个人和团队：能够在多学科背景下的团队中承担个体、团队成员以及负责人的角色。

（9）沟通：能够就材料化学和矿物及其高分子复合材料相关工程问题与业界同行及社会公众 进行有效沟通和交流，包括撰写报告（论文）和参与学术交流的基本能力。并具备一定的国际视野，掌握一门外语，能够在跨文化背景下进行沟通和交流。

（10)项目管理：理解并掌握工程管理原理与经济决策方法，并能在多学科环境中应用。

（11）终身学习：具有自主学习和终身学习的意识，有不断学习和适应发展的能力。

四、主干学科（Main disciplines）

材料化学。

五、学制与学位（Length of Schooling and Degree）

学制四年。学生修满规定的最低毕业学分，达到毕业要求后，授予工学学士学位。

六、核心课程（Core Courses）

专业核心课程：材料科学基础、材料工程基础、晶体学基础、电路与器件原理、材料力学基础、材料化学、材料物理、工业矿物与岩石、复合材料及工艺学、材料现代测试技术、仪器分析、人工智能与材料基因工程、专业英语与科技写作、结构化学等。

实践课程：实验物理、实验化学、晶体学基础实验，晶体光学、材料现代测试技术、金工实习、教学实习、专业实习、材料制备实验、材料化学专业综合实验和毕业论文等。

Undergraduate Program in Materials Chemistry

1. Major Introduction

Materials Chemistry Major origins from Chemistry Department founded in 1995. It is independent from Chemistry Department in 2006. Relying on the advantages of mineral resource utilization at China University of Geosciences (Beijing), a special major focusing on mineral/polymer composite materials has been fabricated, aiming at the research and development and application of new materials to cultivate students in morality, intelligence, physique, aesthetics, and labor. After years of accumulation, a teaching team composed of national-level talents has been biult to develop mineral materials, mineral composite materials, new energy materials, biomedical materials, environmental materials. And the major was approved for the construction of first-class majors in Beijing in 2022。

2. Academic Objectives

Materials chemistry faces the requirement of our country in new materials, new technologies and new proceedings to cultivate high-quality and innovative talents with good professional ethics, systematic professional theoretical knowledge, good humanities literacy, good moral character, solid foundation, extensive knowledge and profound specialty, finally form complex talents in new materials, new energy, environmental and chemistry. After five years of practical work, the graduates of this major can engage in the basic theoretical research in material chemistry and polymer composite materials, the development of new materials and technologies, design of new processes and new technologies, and production technology management as well as teaching and study in universities. The specific training objectives are as follows:

(1) Physical and mental health, good moral character, good professional ethics, sense of social responsibility, innovative quality, understanding the national guidelines, policies and regulations on the development of materials science, with a high sense of safety, environmental protection and sustainable development.

(2) Have the basic knowledge of natural science required for scientific researchin the field of material chemistry and mineral/polymer composite research, engineering design and technical services in materials science and engineering. Have innovation ability and could study, develop and applicate novel material, novel engineering, novel technology. Satisfy the requirement of engineers of our society.

(3) Have good oral and written expression and communication skills, organizational ability and strong team spirit. Have the ability to work and manage as a leader in the team.

(3) Be familiar with the development status and trend of professional direction, and have the ability to design, prepare, testing, analysis and application material products in the professional approach. With strong innovation ability, have the ability to comprehensively analyze and solve practical engineering problems by using the knowledge learned.

(4) Be able to innovate, update knowledge continuously in time and undertake scientific research related to polymers, minerals, mineral composites independently or collaboratively;

and lifelong learning ability.

(5) Have good professional quality, rich engineering management experience and the ability to adapt to the development of the industry, and become a technical backbone or management talent in enterprises and institutions related to minerals and mineral composites.

3. Graduation Requirements

Based on materials science, chemistry and physics, the major of materials science and engineering systematically studies the basic theory and practical skills of materials science and materials chemistry, and applies them to the synthesis, preparation and performance optimization of materials. Students of this major need to master the basic theory and technology in the field of materials science and materials chemistry, have a solid foundation in the field of mineral, composite

materials, and related fields. The graduates should obtain the following knowledge and ability:

(1) Engineering knowledge: be able to apply mathematics, natural science, engineering foundation and professional knowledge to solve practical engineering problems related to material chemistry.

(2) Problem analysis: be able to apply the basic principles of mathematics, natural science and engineering science, combined with literature research, to analyze practical engineering problems related to material chemistry, and obtain effective conclusions.

(3) Design/develop solutions: be able to design solutions for practical engineering problems related to material chemistry, and be innovative and take social, health, safety, legal, cultural and environmental factors into consideration.

(4) Research: be able to conduct research on practical engineering problems related to material chemistry based on scientific principles via using scientific methods, and finally get reasonable and effective conclusions through designing experiments, analyzing and interpreting data.

(5)Use modern tools: be able to master certain modern engineering tools and information technology tools, and could solve practical engineering problems related to material chemistry.

(6) Engineering and society: be able to conduct reasonable analysis based on engineering background knowledge, evaluate the impact of solutions to engineering problems related to material chemistry on society, health, safety, law and culture, and understand the responsibilities to be assumed.

(7) Environment and sustainable development: be able to understand and evaluate the impact of professional engineering practice on the environmental and social sustainable development of engineering problems related to material chemistry.

(8) Individuals and Teams: be capable of acting as individuals, team members and leaders in a multidisciplinary team.

(9) Communication: be able to effectively communicate with peers and the public on engineering issues related to material chemistry, including the basic ability to write reports (papers) and participate in academic exchanges; have a certain international vision, master a foreign language, can communicate under the cross-cultural background.

(10) Project Management: be able to understand and master engineering management principles and economic decision-making methods, and apply them in a multidisciplinary environment.

(11) Lifelong learning: have the consciousness of independent learning and lifelong learning, and have the ability to continuously learn and adapt to development.

4. Main disciplines

Materials chemistry.

5. Length of Schooling and Degree

The length of schooling is four years of full-time study. Students will be awarded the Bachelor Degree of Engineering when they have completed the required minimum credits and have met all other requirements.

6. Core Courses

Core Courses: Fundamentals of Materials Engineering, Fundamentals of Crystallography, Fundamentals of Material Mechanics, Materials Physics, Principles of Circuits and Devices, Industrial Minerals and Rocks, Modern Techniques for Materials, Material Chemistry, Structural Chemistry, Composite Materials and technology, Specialty English for Materials Chemistry, etc.

Practice: Physics Experiments, Chemistry Experiments, Fundamental Experiments of Crystallography, Modern Measurement Experiments, Crystal Optics Experiment, Metalworking Practice, Teaching Practice, Special Practice, Materials Preparation Experiment, Special Comprehensive Experiment and Graduation thesis.

七、最低毕业总学分要求及学分分配（Minimum Required Credits and Distribution）

课程模块 Courses Module	课程类别 Course Classification	学时数 Hours	学分 Credits	学 期 Semester										
				1	2	1 夏	3	4	2 夏	5	6	3 夏	7	8
通识教育 Liberal Education	通识教育必修课程 Required Courses of General Education	682	38	13.25	10.25		4.25	3.25		4.25	2.25		0.25	0.25
	通识教育选修课程 Selective Courses of General Education	160	10											
专业教育 Professional Education	学科基础课程 Disciplinary Fundamental Courses	576	36	14	9		11	2						
	专业核心课程 Specialized Fundamental Courses	464	29				2	11		9.5	4.5		2	
	专业拓展课程（选修 1 个模块） Specialized Development	96	6							2	4			
实践教育 Practical Education	课程实践 Course Practice	30 周+144 学时	34	2	3	2	2	2	5	1	2	6	3	6
	课外实践 Extracurricular Practice		6											
必修课总学分 Required Course Credits				137										
选修课总学分 Elective Course Credits				22										
最低毕业总学分 Total Credits				159										

七、分专业课程设置（Curriculum）

1、专业核心课程（Specialized Core Courses）：256 学时(256 hours)，16 学分(16 Credits)

课程代码 Course Code	课程名称 Courses Name	学时 Hours	学分 Credits	讲课学时 Lec.	实验学时 Exp.	线上学时 Online	考核方式 Assessment	开课学期 Semester	备注 Notes
SR033024	材料工程基础 B Fundamentals of Materials Engineering B	32	2	32			考试 Exam	5	
SR033614	材料物理 C Materials Physics C	24	1.5	24			考试 Exam	5	
SR033017	结构化学 Structural Chemistry	32	2	32			考试 Exam	5	
SR033615	材料化学 Materials Chemistry	32	2	32			考试 Exam	5	
SR033616	仪器分析 Instrumental Analysis	32	2	32			考试 Exam	5	
SR033617	复合材料及工艺学 Process of Polymer Composites	40	2.5	40			考试 Exam	6	
SR033609	人工智能与材料基因工程 Artificial Intelligence and Materials Genome Engineering	32	2	20	12		考试 Exam	6	
SR034618	专业英语与科技写作 Specialized English and Scientific Writing	16	1	16			考试 Exam	7	
SR034619	资源循环与利用 Resource Recycling and Application	16	1	16			考试 Exam	7	
总计 Total		256	16	244	12				

2、专业拓展课程（Specialized Development Courses）：选修 1 个模块，96 学时(96 hours)，6 学分(6 Credits)

课程代码 Course Code		课程名称 Courses Name	学时 Hours	学分 Credits	讲课学时 Lec.	实验学时 Exp.	线上学时 Online	考核方式 Assessment	开课学期 Semester	备注 Notes
SS033638	**模块 1 先进高分子材料**	高分子化学 Polymer Chemistry	32	2	32			考试 Exam	5	
SR033019		高分子物理 Polymer Physics	32	2	32			考试 Exam	6	
SS033639		先进高分子材料 Advanced Polymer Materials	32	2	32			考试 Exam	6	
SS033640	**模块 2 先进纳米材料**	纳米材料与技术 Nano-materials and Technology	32	2	32			考试 Exam	5	
SS033641		胶体与界面化学 Colloid and Interface Chemistry	32	2	32			考试 Exam	6	
SS033642		催化与能源材料 Catalytic and Energetic Materials	32	2	32			考试 Exam	6	

3、课程实践（Course Practice）：31 周+200 学时 (31 Weeks and 200Hours)，34 学分 (34 Credits)

课程代码 Courses Code	课程名称 Courses Name	周（学时） Weeks（hours）	学分 Credits	考核方式 Assessment	开课学期 Semester	备注 Notes
PR311602	军事技能训练 Military Theory and Practice	2 周	2	考查 Term Paper	1	
PR181010	思想政治社会实践 Political Social Practice	32 学时	2	考查 Term paper	1 夏	

课程代码 Courses Code	课程名称 Courses Name	周（学时） Weeks（hours）	学分 Credits	考核方式 Assessment	开课学期 Semester	备注 Notes
PR191045	实验物理（1） Physics Experiments (1)	24 学时	1	考试 Exam	2	
PR191046	实验物理（2） Physics Experiments (2)	24 学时	1	考试 Exam	3	
PR191047	实验化学 Chemistry Experiments	48 学时	2	考试 Exam	2	
PR032655	晶体学基础实验 Fundamental Experiments of Crystallography	1 周	1	考查 Term paper	3	
PR032656	材料现代测试技术实验 Modern Techniques for Materials Characterization Experiments	1 周	1	考查 Term paper	4	
PR032117	晶体光学 Crystal Optics	24 学时	1	考试 Exam	4	
PR033657	材料工程基础设计 Design Practice for Fundamentals of Materials Engineering	1 周	1	考查 Term paper	5	
PR033658	材料化学制备实验 Materials Preparation	48 学时	2	考查 Term paper	6	
PR034659	材料化学专业综合实验 Special Comprehensive Experiments of Material Chemistry Major	3 周	3	考查 Term paper	7	
PR022099	金工实习 Metalworking Practice	1 周	1	考查 Term paper	2 夏	
PR032046	教学实习 Teaching Practice	4 周	4	考查 Term paper	2 夏	

课程代码 Courses Code	课程名称 Courses Name	周（学时） Weeks（hours）	学分 Credits	考核方式 Assessment	开课学期 Semester	备注 Notes
PR033047	专业实习 Professional Practice	6 周	6	考查 Term paper	3 夏	
PR034049	毕业设计（论文） Graduation Design (Thesis)	12 周	6	考查 Term Paper	8	
总计 Total		31 周+200 学时	34			

4、课外实践（Extracurricular practice）：6 学分 (6 Credits)

包括主题教育活动、社会实践、志愿服务、勤工助学、学科竞赛、文体活动、创新创业活动、劳动实践等，其学分的认定按照教务处相关规定执行。

Extracurricular practice include Theme Education, Social Practice, Volunteer Service, Work-study Program, Discipline Competition, Cultural and Sports Activities, Innovative and Entrepreneurial Activities, Labor Practice and so on. The recognition of the credits for innovcation and entrepreneurship shall be implemented according to the regulations of Academic Affairs Office.

八、毕业要求与培养目标矩阵

毕业要求	培养目标				
	目标 1	目标 2	目标 3	目标 4	目标 5
毕业要求1		√			
毕业要求2		√			
毕业要求3		√		√	
毕业要求4		√		√	
毕业要求5		√			
毕业要求6	√				
毕业要求7	√				
毕业要求8	√				√
毕业要求9			√		
毕业要求10			√		
毕业要求11					√

在相应的毕业要求与培养目标里划 √

九、课程与毕业要求关系矩阵

毕业要求 课程名称	（1）工程知识	（2）问题分析	（3）设计/开发解决方案	（4）研究	（5）使用现代工具	（6）工程与可持续发展	（7）工程伦理与职业规范	（8）个人和团队	（9）沟通	（10）项目管理	（11）终身学习
思想道德与法治							H		L		
中国近现代史纲要							L				L
马克思主义基本原理							L				
毛泽东思想和中国特色社会主义理论体系概论							L				
习近平新时代中国特色社会主义思想概论							L				
形势与政策							L				
大学生职业生涯规划与就业指导（1）（2）							M				H
大学生心理素质教育（1）（2）								L			
劳动教育与双创实践（1）（2）							H				
军事理论								L			
大学英语（1）（2）									H		
大学英语素质拓展课									L		
体育（1）（2）（3）（4）（系列课程）								L	L		L
人工智能概论					H						
生态文明（自然文化、碳中和）						H	H				
材料类专业导论											H
材料实验与实践安全							H				
高等数学 A(1) (2)		H		L							

线性代数 A	L										
概率论	L										
大学物理 B(1) (2)				M							
无机化学 A		H									
有机化学 C		H									
物理化学 B			H								
工程图学	H										
材料力学基础	H					H					
晶体学基础				M							
工业矿物与岩石				H		M					
材料科学基础	H										
材料现代测试技术				H	H						
材料工程基础 B	H		H								
材料工程基础设计			H					H			
材料化学		H		H							
材料物理 C	H	H									
专业英语与科技写作									H		
复合材料及工艺学			H	H							
仪器分析					H						
结构化学		M									
人工智能与基因材料工程	H				H						
资源循环利用							H			M	
高分子化学		H		H							
高分子物理				M							
纳米材料与技术		L									
胶体与界面化学		L									
催化与能源材料		H									
军事技能训练								H			
思想政治社会实践							L				

实验物理 1				M	H						
实验物理 2				M	H						
实验化学				M	H						
金工实习				H							
晶体学基础实验					H						
晶体光学					H						
材料现代测试技术实验					H						
毕业设计（论文）		H	H	H				H	H		H
材料化学专业综合实验				H							
材料化学制备实验				H							
专业实习			H					H			H
教学实习									H		H
主题教育活动、社会实践、志愿服务、勤工助学、学科竞赛、文体活动、创新创业活动、劳动实践等									H		H

材料物理专业培养方案

Undergraduate Program in Materials Physics

一、专业简介（Major Introduction）

本专业面向国家战略性新兴产业和区域经济社会发展需求，以功能材料为核心方向，深度融合物理学、材料科学与工程及器件技术，构建物理原理—材料设计—器件应用一体化的人才培养体系。专业特色鲜明，紧扣功能材料的基本物理效应及其器件化应用，重点发展矿物功能材料、先进薄膜、异质结构、光电磁多功能材料，并积极拓展在柔性传感与显示、环境治理、新能源转换与存储等新兴领域的交叉应用。

二、专业培养目标（Academic Objectives）

本专业面向国家战略需求，适应材料科学与工程未来发展方向，德智体美劳全面发展，掌握材料物理专业的基本理论、基本方法和基本技能，得到材料工程师基本训练，能够胜任功能材料、矿物新材料及器件研制相关领域的技术、管理和研究开发工作，具有较强的实践和创新创业能力，具备一定的国际视野和可持续发展潜力，“品德优良、基础厚实、知识广博、专业精深”的材料科学与工程一流拔尖创新人才。

经过五年左右的实践，应达到以下目标：

1）恪守工程行业职业道德与社会伦理，依托自身专业能力对接产业、国家发展需求，主动履行行业从业者的社会责任，保持良好职业操守。

2）可在薄膜功能材料、光电磁功能材料、矿物功能材料等细分领域，独立开展工程设计、技术开发、生产运维、项目管理相关工作，达到合格材料工程师的岗位从业要求。

3）具备良好跨团队协作、跨文化沟通、科学决策能力，可担任项目骨干，具备牵头小型技术团队、承担局部管理工作的发展潜力。

4）拥有持续自主学习、工程创新的能力，能够独立或协作开展功能材料及其器件的技术改良、应用研究类科研工作，适配产业技术迭代需求。

5）依托岗位实践逐步积累工程管理经验，成长为相关企事业单位的核心技术骨干或是技术管理人员。

三、毕业要求（Graduation Requirements）

掌握材料物理的基础理论及基本知识，接受材料制备、结构分析、性能测试的基本训练，掌握材料的成分与组织结构、制备与加工工艺和环境等与材料性能之间关系的基本规律，掌握材料设计、制备与工艺控制的基本方法，以广泛适应材料科学与工程及其相关领域的要求。

毕业生应获得以下几个方面的知识和能力：

1）工程知识：能够将数学、自然科学、计算、工程基础和专业知识用于解决功能材料相关的复杂工程问题。

2）问题分析：能够应用数学、自然科学和工程科学的基本原理，识别、表达功能材料领域的复杂工程问题，结合文献调研开展分析，综合考量可持续发展约束条件，推导获得有效结论。

3）设计/开发解决方案：能够针对功能材料相关复杂工程问题，设计开发对应的解决方案、系统单元或工艺流程；在设计环节融入创新意识，综合考量社会、健康、安全、法律、文化、环境、全生命周期成本、净零碳排放等约束因素。

4）研究：能够基于科学原理并采用科学方法对功能材料相关复杂工程问题开展研究，完成实验方案设计、数据采集、分析与解释，结合多源信息综合研判，最终得到合理可靠的结论。

5）使用现代工具：能够针对功能材料领域复杂工程问题，选用、适配现代工程工具与信息技术工具开展计算、预测和模拟，依托工具辅助完成工程分析；同时明晰各类工具的适用范围与固有局限性，审慎校验工具输出结果以支撑工程决策。

6）工程与可持续发展：在解决功能材料复杂工程问题时，能够依托工程背景知识，分析、

评价工程实践对于健康、安全、环境、法律、经济、社会层面的长期影响，对标可持续发展目标研判方案可行性，充分理解自身需要承担的工程社会责任。

7）工程伦理和职业规范：树立工程报国、为民造福的价值理念，具备人文社会科学素养与社会责任感；能够辨识工程活动涉及的多方利益诉求，理解并践行工程伦理准则，在工程实践中严格遵守工程职业规范、相关法律法规，主动履行职业与社会责任。

8）个人和团队：能够参与多学科背景下的工程团队，胜任普通团队成员、分项负责人等不同角色，协同完成功能材料领域各类工程任务。

9）沟通：能够围绕功能材料相关物理及工程问题，和行业从业者、社会公众开展高效沟通交流；具备撰写技术报告、学术论文、参与学术交流的基础能力，拥有一定国际视野，熟练运用一门外语，可完成跨文化场景下的专业沟通协作。

10）项目管理：理解并掌握工程项目管理原理、经济决策方法，可将相关方法应用于多学科协作的功能材料工程项目当中，统筹管控项目成本、进度与技术风险。

11）终身学习：具备自主学习、终身学习以及批判性思维的意识，能够主动跟踪材料行业技术变革与产业发展趋势，持续更新知识体系，适配行业长期发展带来的能力升级需求。

四、主干学科（Main disciplines）

材料物理。

五、学制与学位（Length of Schooling and Degree）

学制四年。学生修满规定的最低毕业学分，达到毕业要求后，授予工学学士学位。

六、核心课程（Core Courses）

专业核心课程：材料力学基础、晶体学基础、工业矿物与岩石、材料科学基础、材料现代测试技术、电路与器件原理、量子力学、固体物理、功能材料与器件、材料物理 A、半导体物理、材料计算与机器学习、材料物理专业英语、材料工程基础 B、光电催化材料、波谱与能谱分析、纳米材料、薄膜材料、复合材料学、柔性电子与高性能高分子材料等。

实践课程：实验物理、实验化学、晶体光学、晶体学基础实验、材料现代测试技术实验、金工实习、教学实习、专业实习、材料物理制备与性能实验、材料物理专业综合实验和毕业论文等。

Undergraduate Program in Materials Physics

1. Major Introduction

This program is oriented toward the national strategic emerging industries and the demands of regional economic and social development. With functional materials as its core direction, it deeply integrates physics, materials science and engineering, and device technologies to establish a talent cultivation system that seamlessly unifies physical principles–materials design– device applications. The program features distinctive strengths, closely centering on the fundamental physical effects of functional materials and their device-oriented applications. It places special emphasis on mineral-based functional materials, advanced thin films and heterostructures, and optoelectromagnetic multifunctional materials, while actively expanding cross-disciplinary applications in emerging fields such as flexible sensing and display, environmental remediation, new energy conversion, and storage.

2. Academic Objectives

This program is oriented toward national strategic demands and aligned with the future development directions of materials science and engineering. It aims to cultivate well-rounded talents with moral, intellectual, physical, aesthetic, and labor education, who master the fundamental theories, basic methods, and essential skills of materials physics, and receive basic training as materials engineers. Graduates are expected to be competent in technical, managerial, and R&D work in fields related to functional materials, new mineral materials, and device development, with strong practical abilities and innovation and entrepreneurship capabilities, possessing a certain international perspective and sustainable development potential. The program seeks to produce first-class innovative talents in materials science and engineering who are "morally sound, solidly grounded in fundamentals, broadly knowledgeable, and professionally proficient."

After approximately five years of practice, graduates are expected to achieve the following objectives:

1) Adhere to professional ethics and social norms in the engineering industry; leverage professional competence to align with industrial and national development needs; proactively fulfill the social responsibilities of industry practitioners; and maintain sound professional conduct.

2) Independently carry out engineering design, technical development, production operation and maintenance, and project management in specialized fields such as thin-film functional materials, optoelectronic and electromagnetic functional materials, and mineral functional materials, meeting the job requirements for qualified materials engineers.

3) Possess strong capabilities in cross-team collaboration, cross-cultural communication, and scientific decision-making; be capable of serving as project core members, with the development potential to lead small technical teams and undertake partial managerial responsibilities.

4) Demonstrate the capacity for continuous self-directed learning and engineering innovation; independently or collaboratively conduct technical improvement and applied research in functional materials and their devices, adapting to the iterative technological demands of the industry.

5) Gradually accumulate engineering management experience through professional practice, and grow into core technical backbones or technical managers in relevant enterprises and institutions.

3. Graduation Requirements

Graduates shall master the fundamental theories and basic knowledge of materials physics, receive basic training in materials preparation, structural analysis, and performance testing, understand the basic laws governing the relationships between material composition/microstructure, preparation/processing techniques, and environmental factors with material properties, and master the basic methods of materials design, preparation, and process control, so as to broadly adapt to the requirements of materials science and engineering and related fields.

Graduates should acquire the following knowledge and abilities:

1) Engineering Knowledge: be able to apply mathematics, natural sciences, computing, engineering fundamentals, and professional knowledge to solve complex engineering problems related to functional materials.

2) Problem Analysis: be able to apply the basic principles of mathematics, natural sciences, and engineering sciences to identify and formulate complex engineering problems in the field of functional materials; conduct analysis in conjunction with literature research; comprehensively consider sustainable development constraints; and derive valid conclusions through reasoned analysis.

3) Design/Development of Solutions: be able to design and develop corresponding solutions, system components, or process flows for complex engineering problems related to functional materials; incorporate innovation awareness into the design process; and comprehensively consider constraints including social, health, safety, legal, cultural, environmental, life-cycle cost, and net-zero carbon emission factors.

4) Research: be able to conduct research on complex engineering problems related to functional materials based on scientific principles and using scientific methods; complete experimental design, data collection, analysis, and interpretation; integrate multi-source information for comprehensive judgment; and ultimately reach reasonable and reliable conclusions.

5) Use of Modern Tools: be able to select and adapt modern engineering tools and information technology tools to perform computation, prediction, and simulation for complex engineering problems in the field of functional materials; utilize tools to assist in engineering analysis; and clearly understand the scope of application and inherent limitations of various tools, carefully verifying tool outputs to support engineering decision-making.

6) Engineering and Sustainable Development: when solving complex engineering problems in functional materials, be able to draw upon engineering background knowledge to analyze and evaluate the long-term impacts of engineering practice on health, safety, environment, law, economy, and society; assess the feasibility of solutions against sustainable development goals; and fully understand the engineering social responsibilities they are required to undertake.

7) Engineering Ethics and Professional Norms: establish the value concept of serving the nation through engineering and benefiting the people; possess humanities and social sciences literacy and a sense of social responsibility; be able to identify the multi-stakeholder interests involved in engineering activities; understand and practice engineering ethics principles; and strictly comply with engineering professional norms and relevant laws and regulations in engineering practice, proactively fulfilling professional and social responsibilities.

8) Individual and Teamwork: be able to participate in engineering teams under multidisciplinary backgrounds; competently serve in different roles such as regular team member or sub-project leader; and collaboratively complete various engineering tasks in the field of functional materials.

9) Communication: be able to communicate effectively with industry practitioners and the general public on physics and engineering issues related to functional materials; possess the fundamental ability to write technical reports and academic papers and to participate in academic exchanges; have a certain international perspective; be proficient in at least one foreign language; and be capable of professional communication and collaboration in cross-cultural contexts.

10) Project Management: understand and master the principles of engineering project management and economic decision-making methods; be able to apply relevant methods to multidisciplinary functional materials engineering projects; and holistically manage project costs, schedules, and technical risks.

11) Lifelong Learning: possess the awareness for self-directed learning, lifelong learning, and critical thinking; be able to proactively track technological changes and industrial development trends in the materials industry; continuously update one's knowledge system; and adapt to the capability upgrading demands brought by long-term industry development.

4. Main disciplines

Materials Physics.

5. Length of Schooling and Degree

The length of schooling is four years of full-time study. Students will be awarded the Bachelor Degree of Engineering when they have completed the required minimum credits and have met all other requirements.

6. Core Courses

Core Specialized Courses: Fundamentals of Materials Mechanics, Fundamentals of Crystallography, Industrial Minerals and Rocks, Fundamentals of Materials Science, Modern Materials Testing Techniques, Principles of Circuits and Devices, Quantum Mechanics, Solid State Physics, Functional Materials and Devices, Materials Physics A, Semiconductor Physics, Computational Materials Science and Machine Learning, Professional English for Materials Physics, Fundamentals of Materials Engineering B, Photoelectrocatalytic Materials, Wave and Energy Spectrum Analysis, Nanomaterials, Thin-Film Materials, Composite Materials, Flexible Electronics and High-Performance Polymer Materials, etc.

Practical Courses: Experimental Physics, Experimental Chemistry, Crystal Optics Experiments, Fundamental Experiments of Crystallography, Modern Techniques for Materials Characterization Experiments, Metalworking Practice, Teaching Practice, Professional Practice, Experiments on Preparation and Properties of Materials Physics, Comprehensive Experiments in Materials Physics, and Graduation Thesis, etc.

七、最低毕业总学分要求及学分分配（Minimum Required Credits and Distribution）

课程模块 Courses Module	课程类别 Course Classification	学时数 Hours	学分 Credits	学 期 Semester										
				1	2	1 夏	3	4	2 夏	5	6	3 夏	7	8
通识教育 Liberal Education	通识教育必修课程 Required Courses of General Education	682	38	13.25	10.25		4.25	3.25		4.25	2.25		0.25	0.25
	通识教育选修课程 Selective Courses of General Education	160	10											
专业教育 Professional Education	学科基础课程 Disciplinary Fundamental Courses	576	36	14	9		11	2						
	专业核心课程 Specialized Fundamental Courses	456	28.5				2	11		8.5	6		1	
	专业拓展课程（选修 1 个模块） Specialized Development	120	7.5							3.5/4.5	4/3			
实践教育 Practical Education	课程实践 Course Practice	31 周+200 学时	34	2	3	2	2	2	5		2	6	4	6
	课外实践 Extracurricular practice		6											
必修课总学分 Required course credits				136.5										
选修课总学分 Elective course credits				23.5										
最低毕业总学分 Total Credits				160										

七、分专业课程设置（Curriculum）

1、专业核心课程（Specialized Core Courses）：248 学时(248 hours)，15.5 学分(15.5 Credits)

课程代码 Course Code	课程名称 Courses Name	学时 Hours	学分 Credits	讲课学时 Lec.	实验学时 Exp.	线上学时 Online	考核方式 Assessment	开课学期 Semester	备注 Notes
SR033624	量子力学 Quantum Mechanics	32	2	32			考试 Exam	5	
DR192039	固体物理 Solid State Physics	32	2	32			考试 Exam	5	
SR033620	材料物理 A Materials Physics	40	2.5	40			考试 Exam	5	
SR033024	材料工程基础 B Fundamentals of Materials Engineering B	32	2	32			考试 Exam	5	
SR033621	功能材料与器件 Functional Materials and Devices	32	2	32			考试 Exam	6	
SR033119	半导体物理 Semiconductor Physics	32	2	30	2		考试 Exam	6	
SR033622	材料计算与机器学习 Computational Materials Science and Machine Learning	32	2	20	12		考试 Exam	6	
SR034623	材料物理专业英语与科技写作 Specialized English and Scientific Writing	16	1	16			考试 Exam	7	
总计 Total		248	15.5	234	14				

2、专业拓展课程（Specialized Development Courses）：选修 1 个模块，120 学时(120 hours)，7.5 学分(7.5 Credits)

课程代码 Course Code		课程名称 Courses Name	学时 Hours	学分 Credits	讲课学时 Lec.	实验学时 Exp.	线上学时 Online	考核方式 Assessment	开课学期 Semester	备注 Notes
SS033643	**模块 1 功能材料化学与表征**	波谱与能谱分析 Spectral and Energy Spectrum Analysis	24	1.5	24			考试 Exam	5	
SS033638		高分子化学 Polymer Chemistry	32	2	32			考试 Exam	5	
SS033644		光电催化材料 Photoelectrocatalytic Materials	32	2	28	4		考试 Exam	6	
SR033029		纳米材料 Nano-materials	32	2	28	4		考试 Exam	6	
SR033122	**模块 2 功能材料物理与器件**	薄膜材料 Thin Film Materials	40	2.5	40			考试 Exam	5	
SR033019		高分子物理 Polymer Materials	32	2	32			考试 Exam	5	
SS033645		复合材料学 Composite Materials Science	24	1.5	24			考试 Exam	6	
SS033646		柔性电子与高性能高分子材料 Flexible Electronics and High-Performance Polymer Materials	24	1.5	24			考试 Exam	6	

3、课程实践（Course Practice）：31 周+200 学时 (31 Weeks and 200 Hours)，34 学分 (34 Credits)

课程代码 Courses Code	课程名称 Courses Name	周（学时） Weeks（hours）	学分 Credits	考核方式 Assessment	开课学期 Semester	备注 Notes
PR311602	军事技能训练 Military Theory and Practice	2 周	2	考查 Term Paper	1	
PR181010	思想政治社会实践 Political Social Practice	32 学时	2	考查 Term paper	1 夏	
PR191045	实验物理（1） Physics Experiments (1)	24 学时	1	考试 Exam	2	
PR191046	实验物理（2） Physics Experiments (2)	24 学时	1	考试 Exam	3	
PR191047	实验化学 Chemistry Experiments	48 学时	2	考试 Exam	2	
PR032655	晶体学基础实验 Fundamental Experiments of Crystallography	1 周	1	考查 Term paper	3	
PR032656	材料现代测试技术实验 Modern Techniques for Materials Characterization Experiments	1 周	1	考查 Term paper	4	
PR032117	晶体光学 Crystal Optics	24 学时	1	考试 Exam	4	
PR033050	材料物理制备与性能实验 Preparation and Property of Materials Physics	48 学时	2	考查 Term paper	6	
PR034051	材料物理专业综合实验 Specialty Comprehensive Experiments	4 周	4	考查 Term paper	7	
PR022099	金工实习 Metalworking Practice	1 周	1	考查 Term paper	2 夏	

课程代码 Courses Code	课程名称 Courses Name	周（学时） Weeks（hours）	学分 Credits	考核方式 Assessment	开课学期 Semester	备注 Notes
PR032052	教学实习 Teaching Practice	4 周	4	考查 Term paper	2 夏	
PR033053	专业实习 Professional Practice	6 周	6	考查 Term paper	3 夏	
PR034054	毕业设计（论文） Graduation Design (Thesis)	12 周	6	考查 Term Paper	8	
总计 Total		31 周+200 学时	34			

4、课外实践（Extracurricular practice）：6 学分（6 Credits）

包括主题教育活动、社会实践、志愿服务、勤工助学、学科竞赛、文体活动、创新创业活动、劳动实践等，其学分的认定按照教务处相关规定执行。

Extracurricular practice include Theme Education, Social Practice, Volunteer Service, Work-study Program, Discipline Competition, Cultural and Sports Activities, Innovative and Entrepreneurial Activities, Labor Practice and so on. The recognition of the credits for innovcation and entrepreneurship shall be implemented according to the regulations of Academic Affairs Office.

八、毕业要求与培养目标矩阵（工程教育认证类专业）

毕业要求	培养目标				
	目标 1	目标 2	目标 3	目标 4	目标 5
毕业要求1		√			
毕业要求2		√			
毕业要求3		√		√	
毕业要求4		√		√	
毕业要求5		√			
毕业要求6	√				
毕业要求7	√				
毕业要求8	√				√
毕业要求9			√		
毕业要求10			√		
毕业要求11					√

在相应的毕业要求与培养目标里划 √

九、课程与毕业要求关系矩阵（工程教育认证专业类专业参考）

毕业要求 / 课程名称	(1) 工程知识	(2) 问题分析	(3) 设计/开发解决方案	(4) 研究	(5) 使用现代工具	(6) 工程与可持续发展	(7) 工程伦理和职业规范	(8) 个人和团队	(9) 沟通	(10) 项目管理	(11) 终身学习
思想道德与法治							L				
中国近现代史纲要											L
马克思主义基本原理							L				
毛泽东思想和中国特色社会主义理论体系概论							L				
习近平新时代中国特色社会主义思想概论							L				
形势与政策						L	L				
大学生职业生涯规划与就业指导 1,2							M				
大学生心理素质教育 1,2								L			
大学英语 1,2									L		
大学英语素质拓展课									L		
体育 1,2,3,4								L	L		L
人工智能概论					L						
高等数学 A 1,2	L										
线性代数 A	L										
概率论	L										
大学物理 B 1,2	L										
工程图学	H										
无机化学 A	L										
有机化学 C	L										

毕业要求 / 课程名称	(1) 工程知识	(2) 问题分析	(3) 设计/开发解决方案	(4) 研究	(5) 使用现代工具	(6) 工程与可持续发展	(7) 工程伦理和职业规范	(8) 个人和团队	(9) 沟通	(10) 项目管理	(11) 终身学习
物理化学 B	L										
材料类专业导论											H
晶体学基础	M	M									
工业矿物与岩石	M	H									
材料科学基础	M	H				M					
固体物理		M		M							
量子力学	L										
材料现代测试技术				L	H						
材料力学基础	M	M		L		M					
电路与器件原理				L	L						
功能材料与器件	M		H			M					
材料物理 A	M	M									
半导体物理		M		M							
材料计算与机器学习				M	H						
材料物理专业英语与科技写作									M		
材料工程基础 B	H		M								
光电催化材料			M	M							
波谱与能谱分析					H						
高分子化学			M								
纳米材料		M									
薄膜材料			M							L	
复合材料学			M								

毕业要求 / 课程名称	(1) 工程知识	(2) 问题分析	(3) 设计/开发解决方案	(4) 研究	(5) 使用现代工具	(6) 工程与可持续发展	(7) 工程伦理和职业规范	(8) 个人和团队	(9) 沟通	(10) 项目管理	(11) 终身学习
高分子物理		M									
柔性电子与高性能高分子材料			M			L					
军事理论、军事技能训练								M			
思想政治社会实践								M			
实验物理 1,2					L						
实验化学					L						
材料实验与实践安全							H				
材料现代测试技术实验					M						
晶体学基础实验					M						
晶体光学					M						
材料物理制备与性能实验				M	M			M			M
材料物理专业综合实验		L	H	M	M			H	M		
金工实习						L					
教学实习			M			M					
专业实习						M				M	
毕业设计（论文）			H		H				H	H	

新能源材料与器件专业培养方案

Undergraduate Program in New Energy Materials and Devices

一、专业简介（Major Introduction）

中国地质大学（北京）材料科学与工程学院新能源材料与器件专业是面向国家能源革命与绿色低碳发展需求设立的新兴工科专业。本专业以材料科学与工程为核心，深度融合物理学、化学等基础学科，聚焦电化学能量存储与转化、高效太阳能电池、光电催化与绿色氢能、新型储能材料与器件等前沿领域。专业坚持“重基础、强实践、求创新”的培养理念，注重学科交叉与产教融合，强化实践创新能力培养。毕业生可在新能源、新材料、新能源汽车等领域从事科学研究、技术开发、生产管理等工作。

二、专业培养目标（Academic Objectives）

本专业面向“新能源”、“新材料”、“新能源汽车”等国家战略性新兴产业，服务国家能源革命与应对气候变化的重大战略需求，紧密围绕立德树人根本任务，坚持为党育人、为国育才。依托学校在地质、资源、能源、环境领域的主要特色，融合材料、物理、化学等多学科知识，培养德智体美劳全面发展、具有强烈家国情怀与社会责任感，具备过硬思想品质与职业道德素养，数理化基础与专业知识扎实，富有工程思维与创新精神，“品德优良、基础厚实、知识广博、专业精深”的新能源材料与器件领域一流拔尖创新人才，使之成为中国特色社会主义事业的合格建设者和可靠接班人。

经过五年左右的实践，应达到以下目标：

1）恪守工程行业职业道德与社会伦理，依托自身专业能力对接产业、国家发展需求，主动履行行业从业者的社会责任，保持良好职业操守。

2)掌握扎实的数理化基础及新能源、新材料领域专业知识,能够实现多学科知识的融合、迁移与持续提升，达到新能源领域合格材料工程师的岗位从业要求。

3）能分析复杂工程问题，提出创新性研究方案与设计方案，并综合考量工程实践对健康与安全、全生命周期成本、净零碳要求及可持续发展的影响。

4)能在多学科背景团队中有效协作,可担任项目骨干,具备国际视野与跨文化交流能力,可以就复杂工程问题与同行及公众进行良好沟通。

5)具有自主学习与终身学习的意识,能够持续跟踪新能源前沿技术并独立开展方案迭代,可以快速适应社会发展与行业变革。

三、毕业要求（Graduation Requirement）

新能源材料与器件专业以材料学、物理学、化学、数学等为基础，内容涵盖新能源材料与器件专业的基础理论和实验技能。本专业学生掌握新能源材料与器件领域的基础理论及基本知识，接受材料制备、结构分析、性能测试等方面的基本训练，理解材料成分、结构、制备方法、加工工艺与材料性能之间关系的基本规律，掌握材料设计、制备与改性与测试的基本方法，具有较强的实践动手能力，以广泛适应新能源材料与器件及其相关领域的要求。

毕业生应获得以下几个方面的知识和能力：

1）工程知识：具有数学、自然科学、计算、工程基础和专业知识，并能够将其用于解决新能源材料与器件研发与服役过程中的复杂工程问题。

2）问题分析：能够应用数学、自然科学和工程科学的第一性原理，结合文献研究，识别、表达并分析新能源材料与器件在设计、制备、测试、维护中的复杂工程问题，综合考虑可持续发展的要求，得到有效结论。

3）设计/开发解决方案：针对先进二次电池、光伏、氢能等领域复杂工程问题，能够开发和设计解决方案，设计出满足需求的材料和器件、技术和工艺流程，并在设计中体现创新性，同时从健康、安全与环境、全生命周期成本与净零碳要求、法律与伦理、社会与文化等角度考虑可行性。

4）研究：基于专业基本理论，采用合理研究方法和手段，能够对新能源材料与器件工程问题进行研究，包括设计解决方案、实施实验计划、采集实验数据、分析与解释实验结果、得出合理有效的结论。

5）使用现代工具：能够针对先进二次电池、光伏、氢能等领域的复杂工程问题，选择、开发与使用恰当的技术、资源、现代工程工具和信息技术工具，对复杂工程问题进行预测与模拟，并能够理解其局限性。

6）工程与可持续发展：在解决新能源材料与器件领域复杂工程问题时，能够基于工程相关背景知识，分析和评价工程实践对健康、安全、环境、法律以及经济和社会可持续发展的影响，并理解应承担的责任。

7）伦理和职业规范：具备高尚的思想情操与强烈的社会责任感，有工程报国、为民造福的意识，具有人文社会科学素养和社会责任感，能够理解和践行工程伦理，在工程实践中遵守工程职业道德、规范和相关法律，履行责任。

8）个人和团队：能够在多样化、多学科背景下的团队中承担个体、团队成员以及负责人的角色。

9）沟通：能够就新能源材料与器件领域相关复杂工程问题与业界同行及社会公众进行有效沟通和交流，具备撰写报告（论文）和参与学术交流的基本能力，具有一定的国际视野，能够在跨文化背景下进行沟通和交流，理解、尊重语言和文化差异。

10）项目管理：理解并掌握工程管理原理，并能在多学科环境中应用。

11）终身学习：具有自主学习和终身学习的意识，能够理解广泛的技术变革对工程和社会的影响，适应新技术变革，具有批判性思维能力。

四、主干学科（Main disciplines）

新能源材料与器件

五、学制与学位（Length of Schooling and Degree）

学制四年。学生修满规定的最低毕业学分，达到毕业要求后，授予工学学士学位。

六、核心课程（Core Courses）

专业核心课程：晶体学基础、工业矿物与岩石、材料科学基础、材料现代测试技术、电路与器件原理、电化学原理、量子力学、固体物理、人工智能与材料基因工程、材料工程基础 B、先进二次电池材料、太阳能电池原理与设计、氢能与燃料电池、能量转换与存储技术、热电材料与器件、新能源专业英语与科技写作等。

实践课程：实验物理、实验化学、金工实习、教学实习、专业实习、新能源材料与器件制备及性能实验、新能源材料与器件专业综合实验、毕业设计（论文）等。

Undergraduate Program in New Energy Materials and Devices

1. Major Introduction

The New Energy Materials and Devices program at the School of Materials Science and Technology, China University of Geosciences (Beijing), is an emerging engineering discipline established to meet the national demands for the energy revolution and green, low-carbon development. Centered on materials science and engineering, the program deeply integrates fundamental disciplines such as physics and chemistry, and focuses on cutting-edge fields including electrochemical energy storage and conversion, high-efficiency solar cells, photoelectrocatalysis and green hydrogen, as well as novel energy storage materials and devices. Adhering to the educational philosophy of "emphasizing solid foundations, strengthening practice, and pursuing innovation," the program highlights interdisciplinary integration and the fusion of industry and education, while reinforcing the cultivation of practical and innovative abilities. Graduates can pursue careers in scientific research, technology development, and production management in fields such as new energy, new materials, and new energy vehicles.

2. Academic Objectives

This major is oriented towards the three national strategic emerging industries of "new energy", "new materials", and "new energy vehicles". It serves the major strategic demands of the national energy revolution and climate change response. It closely focuses on the fundamental task of fostering virtue and talent, and adheres to cultivating talents for the Party and the country. Relying on the school's main characteristics in the fields of geology, resources, energy, and environment, it integrates knowledge from multiple disciplines such as materials, physics, and chemistry, to cultivate all-round developed talents with a strong sense of patriotism and social responsibility, possessing excellent ideological qualities and professional ethics, solid foundation in mathematics, physics, and chemistry, rich engineering thinking and innovative spirit, and "excellent moral character, profound foundation, extensive knowledge, and profound expertise" in the field of new energy materials and devices. This will enable them to become qualified builders and reliable successors of the cause of socialism with Chinese characteristics.

After about five years of practice, the following goals should be achieved:

1) Uphold professional ethics in the engineering profession and social ethics, leverage their professional competence to align with the development needs of the industry and the nation, proactively fulfill the social responsibilities of industry practitioners, and maintain sound professional integrity.

2) Master solid foundational knowledge in mathematics, physics, and chemistry, as well as specialized knowledge in new energy and new materials fields, and be capable of integrating, transferring and continuously upgrading interdisciplinary knowledge to meet the competency requirements of a qualified materials engineer in the new energy sector.

3) Be capable of analyzing complex engineering problems, proposing innovative research plans and design schemes, and comprehensively consider the impact of engineering practice on health and safety, full life cycle costs, net zero carbon requirements, and sustainable development.

4) Be able to effectively collaborate in multidisciplinary teams, serve as core project members, possess an international perspective and cross-cultural communication competence, and communicate effectively with peers and the general public on complex engineering problems.

5) Have the awareness of self-directed learning and lifelong learning, be able to keep abreast of cutting-edge technologies in new energy and to independently carry out solution iteration, and adapt swiftly to social development and industrial transformation.

3. Graduation Requirements

The major of New Energy Materials and Devices is based on materials science, physics, chemistry, mathematics, etc. Its content covers the basic theories and experimental skills of the field of new energy materials and devices. Students of this major master the basic theories and knowledge in the field of new energy materials and devices, receive basic training in material preparation, structure analysis, performance testing, etc., understand the basic laws of the relationship between

material composition, structure, preparation methods, processing techniques and material performance, master the basic methods of material design, preparation and modification and testing, have strong practical hands-on ability, and can widely adapt to the requirements of the field of new energy materials and devices and related areas.

Graduates should acquire the following knowledge and abilities:

1) Engineering knowledge: Have mathematics, natural sciences, computing, engineering foundation and professional knowledge, and be able to apply them to solve complex engineering problems in the research and service process of new energy materials and devices.

2) Problem analysis: Be able to apply the first principles of mathematics, natural sciences and engineering science, combined with literature research, to identify, formulate and analyze complex engineering problems in the design, preparation, testing and maintenance of new energy materials and devices, comprehensively consider the requirements of sustainable development, and draw valid conclusions.

3) Design/development solutions: For complex engineering problems in fields such as advanced secondary batteries, photovoltaics and hydrogen energy, be able to develop and design solutions, and devise materials and devices, technologies and process flows that meet requirements. Innovations shall be embodied in the design, while feasibility is considered from the perspectives of health, safety and environment, full life cycle costs and net-zero carbon requirements, law and ethics, as well as society and culture.

4) Research: Based on the basic theories of the major, adopt reasonable research methods and means, be able to conduct research on engineering problems in new energy materials and devices, including designing solutions, implementing experimental plans, collecting experimental data, analyzing and interpreting experimental results, and drawing reasonable and effective conclusions.

5) Use modern tools: Be able to select, develop and use appropriate technologies, resources, modern engineering tools and information technology tools for complex engineering problems in advanced secondary batteries, photovoltaics, hydrogen energy and other fields, predict and simulate complex engineering problems, and be able to understand their limitations.

6) Engineering and sustainable development: When solving complex engineering problems in the field of new energy materials and devices, be able to analyze and evaluate the impact of engineering practice on health, safety, environment, law, as well as economic and social sustainable development, and understand the responsibilities to be assumed.

7) Ethics and professional norms: Have the awareness of engineering for the country and benefiting the people, possess humanistic and social sciences literacy and social responsibility, be able to understand and practice engineering ethics in engineering practice, abide by engineering professional ethics, norms and relevant laws, and fulfill responsibilities. Possess noble ideological sentiments and a strong sense of social responsibility, and hold the conviction of serving the country and benefiting the people through engineering. Be equipped with humanistic and social scientific literacy and a sense of social responsibility, be able to understand and practice engineering ethics, abide by engineering professional ethics, norms and relevant laws in engineering practice, and fulfill due responsibilities.

8) Individual and team: Be able to assume the roles of an individual member, a team member and a person in charge in teams with diverse and multidisciplinary backgrounds.

9) Communication: Be able to effectively communicate and exchange with industry peers and the general public on complex engineering problems related to new energy materials and devices. Possess basic abilities to compose reports (theses) and participate in academic exchanges, have a certain international perspective, be able to communicate and exchange in cross-cultural contexts, and understand and respect language and cultural differences.

10) Project management: Understand and master engineering management principles, and be able to apply them in multidisciplinary environments.

11) Lifelong learning: Have the awareness of self-study and lifelong learning, be able to understand the impact of widespread technological changes on engineering and society, adapt to technological changes, and have critical thinking skills.

4. Main disciplines

New Energy Materials and Devices.

5. Length of Schooling and Degree

The length of schooling is four years of full-time study. Students will be awarded the Bachelor Degree of Engineering when they have completed the required minimum credits and have met all other requirements.

6. Core Courses

Core professional courses: Fundamentals of crystallography, Industrial Minerals and Rocks, Fundamentals of Materials Science, Modern Techniques for Materials Characterization, Principles of Circuits and Devices, Principles of Electrochemistry, Quantum Mechanics, Solid State Physics, Artificial Intelligence and Materials Genomics Engineering, Fundamentals of Materials Engineering B, Advanced Secondary Battery Materials, Principles and Design of Solar Cells, Hydrogen Energy and Fuel Cells, Energy Conversion and Storage Technologies, Thermoelectric Materials and Devices, Professional English for New Energy Materials, etc.

Practical courses: Physics Experiments, Chemistry Experiments, Metalworking Practice, Teaching Practice, Professional Practice, Preparation and Performance Experiment of New Energy Materials and Devices, Comprehensive Experiment in New Energy Materials and Devices, and Graduation Design (Thesis), etc.

七、最低毕业总学分要求及学分分配（Minimum Required Credits and Distribution）

课程模块 Courses Module	课程类别 Course Classification	学时数 Hours	学分 Credits	学 期 Semester										
				1	2	1 夏	3	4	2 夏	5	6	3 夏	7	8
通识教育 Liberal Education	通识教育必修课程 Required Courses of General Education	682	38	13.25	10.25		4.25	3.25		4.25	2.25		0.25	0.25
	通识教育选修课程 Selective Courses of General Education	160	10											
专业教育 Professional Education	学科基础课程 Disciplinary Fundamental Courses	576	36	14	9		11	2						
	专业核心课程 Specialized Fundamental Courses	432	27				2	11		10	2		2	
	专业拓展课程（选修 1 个模块） Specialized Development	128	8								8			
实践教育 Practical Education	课程实践 Course Practice	32 周+200 学时	35	2	3	2	2	2	5	1	2	6	4	6
	课外实践 Extracurricular practice		6											
必修课总学分 Required course credits				136										
选修课总学分 Elective course credits				24										
最低毕业总学分 Total Credits				160										

七、分专业课程设置（Curriculum）

1、专业核心课程（Specialized Core Courses）：224 学时(224 hours)，14 学分(14Credits)

课程代码 Course Code	课程名称 Courses Name	学时 Hours	学分 Credits	讲课学时 Lec.	实验学时 Exp.	线上学时 Online	考核方式 Assessment	开课学期 Semester	备注 Notes
SR033624	量子力学 Quantum Mechanics	32	2	32			考试 Exam	5	
DR192039	固体物理 Solid State Physics	32	2	32			考试 Exam	5	
SR033024	材料工程基础 B Fundamentals of Materials Engineering B	32	2	32			考试 Exam	5	
SR033130	电化学原理 Principles of Electrochemistry	32	2	32			考试 Exam	5	
SR033608	矿物材料学 Mineral Materials	32	2	32			考试 Exam	5	
SR033609	人工智能与材料基因工程 Artificial Intelligence and Materials Genome Engineering	32	2	20	12		考试 Exam	6	
SR034625	新能源专业英语与科技写作 Specialized English and Scientific Writing for New Energy	32	2	32			考试 Exam	7	
总计 Total		224	14	212	12				

2、专业拓展课程（Specialized Development Courses）：选修 1 个模块，128 学时(128hours)，8 学分(8Credits)

课程代码 Course Code		课程名称 Courses Name	学时 Hours	学分 Credits	讲课学时 Lec.	实验学时 Exp.	线上学时 Online	考核方式 Assessment	开课学期 Semester	备注 Notes
SS033647	**模块 1 绿色电源**	先进二次电池材料 Advanced Secondary Battery Materials	32	2	32			考试 Exam	6	
SS033648		能量转换与存储技术 Energy Conversion and Storage Technologies	32	2	32			考试 Exam	6	
SS033649		氢能与燃料电池 Hydrogen Energy and Fuel Cells	32	2	32			考试 Exam	6	
SS033644		光电催化材料 Photoelectrocatalytic Materials	32	2	28	4		考试 Exam	6	
SR033132	**模块 2 清洁能源**	太阳能电池原理与设计 Principles and Design of Solar Cells	32	2	32			考试 Exam	6	
SS033647		先进二次电池材料 Advanced Secondary Battery Materials	32	2	32			考试 Exam	6	
SS033650		热电材料与器件 Thermoelectric Materials and Devices	32	2	32			考试 Exam	6	
SR033119		半导体物理 Semiconductor Physics	32	2	32			考试 Exam	6	

3、课程实践（Course Practice）：32 周+200 学时 (32 Weeks and 200 Hours)，35 学分 (35 Credits)

课程代码 Courses Code	课程名称 Courses Name	周（学时） Weeks（hours）	学分 Credits	考核方式 Assessment	开课学期 Semester	备注 Notes
PR311602	军事技能训练 Military Theory and Practice	2 周	2	考查 Term Paper	1	
PR181010	思想政治社会实践 Political Social Practice	32 学时	2	考查 Term paper	1 夏	
PR191045	实验物理（1） Physics Experiments (1)	24 学时	1	考试 Exam	2	
PR191046	实验物理（2） Physics Experiments (2)	24 学时	1	考试 Exam	3	
PR191047	实验化学 Chemistry Experiments	48 学时	2	考试 Exam	2	
PR032655	晶体学基础实验 Fundamental Experiments of Crystallography	1 周	1	考查 Term paper	3	
PR032656	材料现代测试技术实验 Modern Techniques for Materials Characterization Experiments	1 周	1	考查 Term paper	4	
PR032117	晶体光学 Crystal Optics	24 学时	1	考试 Exam	4	
PR033657	材料工程基础设计 Design Practice for Fundamentals of Materials Engineering	1 周	1	考查 Term paper	5	
PR033140	新能源材料与器件制备及性能实验 Preparation and Performance Experiment of New Energy Materials and Devices	48 学时	2	考查 Term paper	6	

课程代码 Courses Code	课程名称 Courses Name	周（学时） Weeks（hours）	学分 Credits	考核方式 Assessment	开课学期 Semester	备注 Notes
PR033141	新能源材料与器件专业综合实验 Comprehensive Experiment in New Energy Materials and Devices	4 周	4	考查 Term paper	7	
PR022099	金工实习 Metalworking Practice	1 周	1	考查 Term paper	2 夏	
PR032144	教学实习 Teaching Practice	4 周	4	考查 Term paper	2 夏	
PR033145	专业实习 Professional Practice	6 周	6	考查 Term paper	3 夏	
PR034143	毕业设计（论文） Graduation Design (Thesis)	12 周	6	考查 Term Paper	8	
总计 Total		32 周+200 学时	35			

4、课外实践（Extracurricular practice）：6 学分（6 Credits）

包括主题教育活动、社会实践、志愿服务、勤工助学、学科竞赛、文体活动、创新创业活动、劳动实践等，其学分的认定按照教务处相关规定执行。

Extracurricular practice include Theme Education, Social Practice, Volunteer Service, Work-study Program, Discipline Competition, Cultural and Sports Activities, Innovative and Entrepreneurial Activities, Labor Practice and so on. The recognition of the credits for innovcation and entrepreneurship shall be implemented according to the regulations of Academic Affairs Office.

八、毕业要求与培养目标矩阵（工程教育认证类专业）

毕业要求	培养目标				
	目标 1	目标 2	目标 3	目标 4	目标 5
毕业要求1		√			
毕业要求2		√		√	
毕业要求3		√		√	
毕业要求4		√		√	
毕业要求5		√	√	√	
毕业要求6	√		√		
毕业要求7	√				
毕业要求8			√		√
毕业要求9			√		√
毕业要求10			√		√
毕业要求11					√

在相应的毕业要求与培养目标里划 √

九、课程与毕业要求关系矩阵（工程教育认证专业类专业参考）

毕业要求 / 课程名称	(1) 工程知识	(2) 问题分析	(3) 设计/开发解决方案	(4) 研究	(5) 使用现代工具	(6) 工程与可持续发展	(7) 工程伦理和职业规范	(8) 个人和团队	(9) 沟通	(10) 项目管理	(11) 终身学习
思想道德与法治							H				
中国近现代史纲要											L
马克思主义基本原理							H				
毛泽东思想和中国特色社会主义理论体系概论							H				
习近平新时代中国特色社会主义思想概论							H				
形势与政策						L	L				
大学生职业生涯规划与就业指导 1,2							M				
大学生心理素质教育 1,2								L			
大学英语 1,2									L		
大学英语素质拓展课									L		
体育 1,2,3,4								L	L		L
人工智能概论					L						
高等数学 A 1,2	L										
线性代数 A	L										
概率论	L										
大学物理 B 1,2	L										
工程图学	H										
无机化学 A	L										
有机化学 C	L										

毕业要求 / 课程名称	(1) 工程知识	(2) 问题分析	(3) 设计/开发解决方案	(4) 研究	(5) 使用现代工具	(6) 工程与可持续发展	(7) 工程伦理和职业规范	(8) 个人和团队	(9) 沟通	(10) 项目管理	(11) 终身学习
物理化学 B	L										
材料类专业导论											H
晶体学基础	M	M									
工业矿物与岩石	M	H									
材料科学基础	M	H				M					
材料现代测试技术				L	H						
材料力学基础	M	M		L		M					
电路与器件原理				L	H						
电化学原理		H									M
量子力学	M			H							M
固体物理	M										H
人工智能与材料基因工程				M	H						
材料工程基础 B	M		M							H	
矿物材料学		M				M					
新能源专业英语与科技写作					M				H		M
先进二次电池材料		H		M							
氢能与燃料电池	H	M				M					
能量转换与存储技术	M			M		H					
光电催化材料			M	H							
太阳能电池原理与设计		H				H					
热电材料与器件	M	H									
半导体物理				H							

毕业要求 / 课程名称	(1) 工程知识	(2) 问题分析	(3) 设计/开发解决方案	(4) 研究	(5) 使用现代工具	(6) 工程与可持续发展	(7) 工程伦理和职业规范	(8) 个人和团队	(9) 沟通	(10) 项目管理	(11) 终身学习
军事理论、军事技能训练								H			
思想政治社会实践								H	M	M	
实验物理 1,2			M		L						
实验化学			M		L						
晶体光学					H						
材料现代测试技术实验		M	M		H						
材料工程基础设计	M		H			H				M	
新能源材料与器件制备及性能实验				M					H		
新能源材料与器件专业综合实验			M		M			M		H	
金工实习	M							H			
教学实习			H			M					
专业实习						M				H	
毕业设计（论文）		H	H	H	H				M	H	H

矿物加工工程专业培养方案

Undergraduate Program in Mineral Process Engineering

一、专业简介（Major Introduction）

矿物加工工程专业是矿业类核心专业，聚焦矿产资源高效分选、清洁利用与高值化深加工，支撑国家资源能源安全、金属/非金属材料供给与“双碳”目标，培养具有良好职业道德、系统掌握矿物分选加工、资源综合利用和工艺设计能力的新工科人才。毕业生能够在矿物分选、矿物材料加工和矿产资源综合利用等领域内从事生产、管理、工程设计、科学研究等工作。

二、专业培养目标（Academic Objectives）

本专业聚焦国家矿产资源重大战略需求，瞄准学科国际学术前沿动态，致力于培养具有良好科学和人文素养、工程哲学思维和国际视野，系统掌握现代矿物加工工程相关理论、方法、技术和工艺，熟练使用现代信息技术与人工智能技术，能够在矿业、环保及新材料等相关领域从事设计、生产、管理、科研等工作的德、智、体、美、劳全面发展的创新型、国际化工程技术人才。本专业的培养目标：

1.身心健康、品德优良、具有良好的职业道德、社会责任感，具有创新素质，了解国家关于矿物加工工程领域发展的方针、政策和法规，具有高度的安全意识、环保意识和可持续发展意识。

2.具有从事矿物加工工程领域科学研究、工程设计和技术服务等工作所需的数理基础知识、专业基础知识和其他相关的自然科学基础知识，具有独立从事与矿物加工相关工作的能力。

3.熟悉专业方向的前沿、发展现状和趋势，具有终生学习能力和较强的创新能力，能有效地解决科研或生产中的实际问题。

4.掌握设计、制备、测试和分析材料制品的仪器设备及应用软件，并具有运用所学知识综合分析和解决工程实际问题的能力。

5.具有良好的口头和书面表达和交流沟通能力，具有组织能力和较强的团队合作精神，能积极适应各类工作环境，成长为专业过硬、素质全面的复合型人才。

三、毕业要求（Graduation Requirement）

矿物加工工程专业以矿物学、地质学、材料学、物理学、化学、数学为基础，内容涵盖矿物加工工程的基础理论和实验技能。本专业学生掌握矿物加工工程领域的基础理论及基本知识，接受结构分析、成分表征、性能测试的基本训练，培养选矿厂设计、管理等相关工程实践能力，能够综合考虑经济、环境、法律、安全等因素的影响，具有较强的团队合作能力，以广泛适应矿物加工工程及其相关领域的要求。

毕业生应该获得以下几方面的知识和能力：

1．工程知识。能够将数学、自然科学、计算、工程基础和专业知识用于解决矿物加工工程相关的工程实际问题。

2．问题分析。能够应用数学、自然科学和工程科学的基本原理，识别、表达并通过文献研究分析矿物加工工程相关的工程实际问题，综合考虑可持续发展的要求，以获得有效结论。

3．设计/开发解决方案。能够针对矿物加工工程相关的工程实际问题设计和开发解决方案，设计满足特定需求的系统、单元（部件）或工艺流程，体现创新性，并从健康、安全与环境、全生命周期成本与净零碳要求、法律与伦理、社会与文化等角度考虑可行性。

4．研究。能够基于科学原理并采用科学方法对矿物加工工程相关的工程实际问题进行研究，包括设计实验、分析与解释数据、并通过信息综合得到合理有效的结论。

5．使用现代工具。能够针对矿物加工工程相关的工程实际问题，开发、选择与使用恰当

的技术、资源、现代工程工具和信息技术工具，包括对矿物加工工程相关的工程实际问题的预测与模拟，并能够理解其局限性。

6．工程与可持续发展。在解决矿物加工工程相关的工程实际问题时，能够基于工程相关背景知识，分析和评价工程实践对健康、安全、环境、法律以及经济和社会可持续发展的影响，并理解应承担的责任。

7．工程伦理和职业规范。有工程报国、为民造福的意识，具有人文社会科学素养和社会责任感，能够理解和践行工程伦理，在工程实践中遵守工程职业道德、规范和相关法律，履行责任。

8．个人与团队。能够在多样化、多学科背景下的团队中承担个体、团队成员以及负责人的角色。

9．沟通。能够就矿物加工工程相关的工程实际问题与业界同行及社会公众进行有效沟通和交流，包括撰写报告和设计文稿、陈述发言、清晰表达或回应指令；能够在跨文化背景下进行沟通和交流，理解、尊重语言和文化差异。

10．项目管理。理解并掌握与工程项目相关的管理原理与经济决策方法，并能够在多学科环境中应用。

11．终身学习。具有自主学习、终身学习和批判性思维的意识和能力，能够理解广泛的技术变革对工程和社会的影响，适应新技术变革。

四、主干学科（Main disciplines）

矿业工程。

五、学制与学位（Length of Schooling and Degree）

学制四年。学生修满规定的最低毕业学分，达到毕业要求后，授予工学学士学位。

六、核心课程（Core Courses）

专业核心课程：矿物加工学（1）、矿物加工学（2）、矿物加工学（3）、选矿厂设计、矿物化学处理、矿物加工研究方法、矿石与工艺矿物学等。

实践课程：晶体光学、矿物加工实验、实验物理、实验化学、物理化学实验、金工实习、教学实习、专业实习、制造工程实验和毕业设计（论文）等。

Undergraduate Program in Mineral Process Engineering

1. Major Introduction

Mineral Processing Engineering is a core major in the mining field, focusing on the efficient separation, clean utilization, and high-value deep processing of mineral resources. It supports national resource and energy security, the supply of metal and non-metal materials, and the "dual carbon" goals. The program aims to cultivate the first-class innovative talents with good professional ethics and systematic mastery of mineral separation and processing, resource comprehensive utilization, and process design capabilities. Graduates can engage in production, management, engineering design, scientific research, and other work in the fields of mineral separation, mineral material processing, and comprehensive utilization of mineral resources.

2. Academic Objectives

This major focuses on major national strategic demands for mineral resources and aligns with cutting-edge international academic developments in the discipline. It is dedicated to cultivating innovative, internationally oriented engineering professionals with sound scientific and humanistic literacy, engineering-philosophical thinking, and a global perspective. These professionals will systematically master theories, methods, technologies, and processes related to modern mineral processing engineering; be proficient in modern information technology and artificial intelligence; and be capable of undertaking design, production, management, and research in mining, environmental protection, new materials, and related fields. The program also fosters all-round development in morality, intelligence, physical fitness, aesthetics, and labor.

The training objectives of this major are:

1) Physically and mentally healthy, with good morality, professional ethics, and social responsibility; possessing innovative qualities; understanding national policies and regulations on the development of Mineral Processing Engineering; and having a strong sense of safety, environmental protection, and sustainable development.

2) Mastering mathematical, physical, professional, and other related natural science basic knowledge required for scientific research, engineering design, and technical services in the field of Mineral Processing Engineering, and having the ability to independently engage in work related to mineral processing.

3) Familiar with the frontiers, current development status, and trends of the professional direction; having lifelong learning ability and strong innovative ability to effectively solve practical problems in scientific research or production.

4) Master the instruments, equipment and application software for designing, preparing, testing and analyzing material products, and have the ability to comprehensively analyze and solve practical engineering problems by applying the learned knowledge.

5) Having good oral and written expression, communication skills, organizational skills, and strong teamwork spirit; being able to actively adapt to various working environments and grow into compound talents with excellent professionalism and comprehensive qualities.

3. Graduation Requirements

The major of Mineral Processing Engineering is based on Mineralogy, Geology, Materials Science, Physics, Chemistry, and Mathematics, covering the basic theories and experimental skills of Mineral Processing Engineering. Students in this major master the basic theories and knowledge in the field of Mineral Processing Engineering, receive basic training in structure analysis, composition characterization, and performance testing, cultivate engineering practice abilities such as mineral processing plant design and management, can comprehensively consider the impacts of economic, environmental, legal,

safety, and other factors, and have strong teamwork abilities to widely adapt to the requirements of Mineral Processing Engineering and its related fields.

Graduates should acquire the following knowledge and abilities:

(1)Engineering knowledge: be able to apply mathematics, natural sciences, computing, engineering fundamentals, and specialized knowledge to solve practical engineering problems related to mineral processing engineering.

(2)Problem analysis: be able to apply the basic principles of mathematics, natural sciences, and engineering sciences to identify, formulate and analyze practical engineering problems in mineral processing engineering through literature research. Consider the requirements of sustainable development to draw valid conclusions.

(3)Design/development solutions: be able to design and develop solutions for practical engineering problems in mineral processing engineering, and design systems, units (components), or process flows that meet specific needs, with demonstration of innovation. Evaluate feasibility from perspectives including health, safety and environment, whole-life cycle costs and net-zero carbon requirements, laws and ethics, as well as society and culture.

(4)Research: be able to conduct research on practical engineering problems in mineral processing engineering based on scientific principles and using scientific methods, including designing experiments, analyzing and interpreting data, and drawing reasonable and valid conclusions through information synthesis.

(5)Use of modern tools: be able to develop, select, and use appropriate technologies, resources, modern engineering tools, and information technology tools for practical engineering problems in mineral processing engineering—including prediction and simulation of such problems—and understand their limitations.

(6)Engineering and sustainable development: when solving practical engineering problems in mineral processing engineering, ability to analyze and evaluate the impacts of engineering practices on health, safety, environment, laws, as well as economic and social sustainable development based on engineering-related background knowledge, and understand the corresponding responsibilities to be undertaken.

(7)Engineering ethics and professional norms: possess the awareness of serving the country through engineering and benefiting the people, along with literacy in the humanities and social sciences and a sense of social responsibility. Ability to understand and practice engineering ethics, abide by engineering professional ethics, norms, and relevant laws in engineering practice, and fulfill responsibilities.

(8)Individual and teamwork: be able to assume the roles of individual, team member, and team leader in teams with diverse and interdisciplinary backgrounds.

(9)Communication: be able to communicate and interact effectively with industry peers and the public on practical engineering problems in mineral processing engineering, including writing reports and design documents, delivering presentations, and expressing or responding to instructions clearly. Ability to communicate and interact in cross-cultural contexts, and understand and respect language and cultural differences.

(10)Project management: be able to understand and master management principles and economic decision-making methods related to engineering projects, and be able to apply them in interdisciplinary environments.

(11)Life-long learning: possess the awareness and ability for autonomous learning, life-long learning and critical thinking, and have the ability to understand the impacts of broad technological changes on engineering and society, and adapt to new technological transformations.

4. Main Disciplines

Mining engineering.

5. Length of Schooling and Degree

The length of schooling is four years of full-time study. After students complete the minimum graduation credits stipulated and meet the graduation requirements, they will be awarded a Bachelor of Engineering degree.

6. Core Courses

Professional Core Courses: Mineral Processing (1), Mineral Processing (2), Mineral Processing (3)，Dressing Plant Design, Mineral Chemical Treatment, Research Methodology on Minerals Processing, Ore and Process Mineralogy, etc.

Practical Courses: Crystal Optics, Mineral Processing Experiments, Experimental Physics, Experimental Chemistry, Physical Chemistry Experiments, Metalworking Practice, Teaching Practice, Professional Practice, Manufacturing Engineering Experiments, Graduation Design (Thesis), etc.

七、最低毕业总学分要求及学分分配（Minimum Required Credits and Distribution）

课程模块 Courses Module	课程类别 Course Classification	学时数 Hours	学分 Credits	学 期 Semester										
				1	2	1 夏	3	4	2 夏	5	6	3 夏	7	8
通识教育 Liberal Education	通识教育必修课程 Required Courses of General Education	682	38	13.25	10.25		4.25	3.25		4.25	2.25		0.25	0.25
	通识教育选修课程 Selective Courses of General Education	160	10											
专业教育 Professional Education	学科基础课程 Disciplinary Fundamental Courses	576	36	14	9		11	2						
	专业核心课程 Specialized Fundamental Courses	472	29.5				2	11		6.5	8		2	
	专业拓展课程 Specialized Development	80	5							3.5	3.5		1.5	
实践教育 Practical Education	课程实践 Course Practice	29 周+248 学时	34	2	3	2	2	2	5	2	2	6	2	6
	课外实践 Extracurricular practice		6											
必修课总学分 Required course credits				137.5										
选修课总学分 Elective course credits				21										
最低毕业总学分 Total Credits				158.5										

八、分专业课程设置（Curriculum）

1、专业核心课程（Specialized Core Courses）：264 学时(264 hours)，16.5 学分(16.5Credits)

课程代码 Course Code	课程名称 Courses Name	总学时 Hours	学分 Credits	讲课学时 Lecture	实验学时 Experiment	线上学时 Online	考核方式 Assessment	开课学期 Semester	备注 Notes
SR033626	矿物加工学（1） Mineral Processing (1)	32	2	32			考试 Exam	5	
SR033627	矿物加工学（2） Mineral Processing (2)	40	2.5	40			考试 Exam	5	
SR033628	矿石与工艺矿物学 Ore and Process Mineralogy	32	2	32			考试 Exam	5	
SR033629	矿物加工学（3） Mineral Processing (3)	32	2	32			考试 Exam	6	
SR033630	矿物化学处理 Mineral Chemical Treatment	32	2	32			考试 Exam	6	
SR033185	矿物加工研究方法 Research Methodology on Minerals Processing	32	2	32			考试 Exam	6	
SR033631	资源工程CAD Resource Engineering CAD	32	2	32			考试 Exam	6	
SR034183	选矿厂设计 Dressing Plant Design	32	2	32			考试 Exam	7	
总计 Total		264	16.5	264					

2、专业拓展课程（Specialized Development Courses）：选修 80 学时(80hours)，5 学分(5 Credits)

课程代码 Course Code	课程名称 Courses Name	学时 Hours	学分 Credits	讲课学时 Lec.	实验学时 Exp.	线上学时 Online	考核方式 Assessment	开课学期 Semester	备注 Notes
SR033608	矿物材料学 Mineral Materials	32	2	32			考试 Exam	5	
SS033632	资源循环与材料化利用 Resource Recycling and Material Utilization	24	1.5	24			考试 Exam	5	
SS033652	矿物加工前沿技术 Advanced Technologies in Mineral Processing	24	1.5	24			考试 Exam	6	
SS033637	新能源材料化学 New Energy Materials Chemistry	32	2	32			考试 Exam	6	
SS034651	智能选矿技术 Intelligent Mineral Processing Technology	24	1.5	24			考试 Exam	7	

3、课程实践（Course Practice）：29 周+248 学时 (29 Weeks and 248 Hours)，34 学分 (34 Credits)

课程代码 Courses Code	课程名称 Courses Name	周（学时） Weeks（hours）	学分 Credits	考核方式 Assessment	开课学期 Semester	备注 Notes
PR311602	军事技能训练 Military Theory and Practice	2 周	2	考查 Term Paper	1	
PR181010	思想政治社会实践 Political Social Practice	32 学时	2	考查 Term paper	1 夏	
PR191045	实验物理（1） Physics Experiments (1)	24 学时	1	考试 Exam	2	
PR191046	实验物理（2） Physics Experiments (2)	24 学时	1	考试 Exam	3	
PR191047	实验化学 Chemistry Experiments	48 学时	2	考试 Exam	2	
PR032655	晶体学基础实验 Fundamental Experiments of Crystallography	1 周	1	考查 Term paper	3	
PR032656	材料现代测试技术实验 Modern Techniques for Materials Characterization Experiments	1 周	1	考查 Term paper	4	
PR032117	晶体光学 Crystal Optics Experiments	24 学时	1	考查 Term paper	4	
PR033660	矿物加工实验（1） Mineral Processing Experiments (1)	48 学时	2	考查 Term paper	5	
PR033661	矿物加工实验（2） Mineral Processing Experiments (2)	48 学时	2	考查 Term paper	6	

课程代码 Courses Code	课程名称 Courses Name	周（学时） Weeks（hours）	学分 Credits	考核方式 Assessment	开课学期 Semester	备注 Notes
PR034662	矿物加工工程专业综合设计实验 Comprehensive Experiments of Mineral Process Engineering	2 周	2	考查 Term paper	7	
PR022099	金工实习 Metalworking Practice	1 周	1	考查 Term paper	2 夏	
PR032663	教学实习 Teaching Practice	4 周	4	考查 Term paper	2 夏	
PR033664	专业实习 Professional Practice	6 周	6	考查 Term paper	3 夏	
PR034665	毕业设计（论文） Graduation Design (Thesis)	12 周	6	考查 Term paper	8	
总计 Total		29 周+248 学时	34			

4、课外实践（Extracurricular practice）：6 学分 (6 Credits)

包括主题教育活动、社会实践、志愿服务、勤工助学、学科竞赛、文体活动、创新创业活动、劳动实践等，其学分的认定按照教务处相关规定执行。

Extracurricular practice include Theme Education, Social Practice, Volunteer Service, Work-study Program, Discipline Competition, Cultural and Sports Activities, Innovative and Entrepreneurial Activities, Labor Practice and so on. The recognition of the credits for extracurricular practice shall be implemented according to the regulations of Academic Affairs Office.