材料类专业培养方案

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、材料物理、材料化学。

Undergraduate Program in Materials

The undergraduate program of materials in the School of Materials Science and Technology includes the major characteristics，for undergraduate major，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 course 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/material chemistry/materials physics.

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，Material Physics，and Material Chemistry.

三、大类课程 (Courses of General Major)

1、通识教育必修课程 (Required Courses of General Education)：746 学时 (746Hours)，41 学分 (41Credits)

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
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	0		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	
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	

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
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			考查 Term paper	1	
GR303006	大学生心理素质教育（2） Mental Health（2）	16	1	16			考查 Term paper	5	
GR302008	军事理论 Military Theory	36	1	36			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 Competence-oriented Education for College English	32	2	32			考试 Exam	2	
GR141005	体育（1）（系列课程） Physical Education（1）	32	1		32		考试 Exam	1	
GR141006	体育（2）（系列课程） Physical Education（2）	32	1		32		考试 Exam	2	
GR141007	体育（3）（系列课程） Physical Education（3）	32	1		32		考试 Exam	3	
GR141008	体育（4）（系列课程） Physical Education（4）	32	1		32		考试 Exam	4	
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	
GR041001	大学计算机	32	2	16	16		考试	1	

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
	College Computer						Exam		
GR041003	程序设计基础 A Fundamentals of Programming A	64	4	24	24	16	考试 Exam	2	
总计 Total		746	41	528	202	16			

2、**通识教育选修**（Selective Courses of General Education）：192 **学时**（192Hours），12 **学分**（12 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	7	考查 Term paper	2-8	4 个类别中选修 7 个学分，其中《大学生安全教育》（1 学分）必选。
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	自然文化类 Natural Culture Courses	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	5-8	
5	创新创业教育类（含在线课程） Innovation and Entrepreneurship Courses (Inc. Online Courses)	见附件 5-6	3	考查 Term paper	2-8	选修 3 个学分，其中《新生研讨课》（1 学分）必选。

6	审美与艺术类 Aesthetics and Art Courses	见附件 7	2	考查 Term paper	2-4	
总计 Total			12			

3、**学科基础课程** (Disciplinary Fundamental Courses)：936 **学时** (936Hours)，58.5 **学分** (58.5Credits)

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
DR191001	高等数学 A（1） Advanced Mathematics A（1）	96	6	96			考试 Exam	1	
DR191002	高等数学 A（2） Advanced Mathematics A（2）	96	6	96			考试 Exam	2	
DR192005	线性代数 Linear Algebra	32	2	32			考试 Exam	3	
DR192006	概率论与数理统计 Probability and Mathematics Statistics	48	3	48			考试 Exam	4	
DR191008	大学物理（1） College Physics (1)	48	3	48			考试 Exam	2	
DR192009	大学物理（2） College Physics (2)	48	3	48			考试 Exam	3	
DR021002	工程图学 Engineering Drawing	48	3	48			考试 Exam	1	
DR191011	无机化学 Inorganic Chemistry	48	3	48			考试 Exam	1	

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
DR032123	分析化学基础 Fundamentals of Analytical Chemistry	16	1	16			考试 Exam	4	
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	
DR030041	材料类专业导论 Introduction to Materials Major	16	1	16			考查 Term paper	1	
DR032003	晶体学基础 Basic course of crystallography	40	2.5	34	6		考试 Exam	3	
DR032006	材料学概论 Introduction to Materials Science	32	2	32			考试 Exam	3	
DR032001	工业矿物与岩石 Industrial Minerals and Rocks	48	3	48			考试 Exam	4	
DR033002	材料科学基础 Fundamentals of Materials Science	48	3	48			考试 Exam	4	
DR032101	量子与统计 Quantum and Statistical Mechanics	32	2	32			考试 Exam	4	
DR032102	材料现代测试技术 Modern Techniques for Materials Characterization	40	2.5	26	14		考试 Exam	4	
DR192039	固体物理 Solid State Physics	32	2	32			考试 Exam	5	
DR033103	材料力学基础 Fundamentals of Material Mechanics	32	2	32			考试 Exam	5	

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
DR042127	电工电子技术 B Electrical and Electronic Technology B	48	3	48			考试 Exam	6	
总计 Total		936	58.5	916	20				

材料科学与工程专业本科培养方案

一、培养目标

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） 具备良好的道德修养和人文社会科学素养，良好的工程职业道德和规范，较强的社会责任感和事业心，基于自身知识和能力，愿意服务于国家与社会，能够承担和履行社会责任；

2） 能够在矿物资源及工业固体废弃物利用、矿物加工、陶瓷和耐火材料等领域，从事材料科学与工程的设计与实施、技术开发、工程管理等工作，胜任材料工程师的工作；

3） 具备较强的团队意识、国际视野、沟通交流能力、合理决策能力和组织管理能力，能够承担团队中的领导角色；

4） 具备创新能力和继续学习能力，能够独立或协同承担矿物及无机非金属材料相关科研工作；

5） 具有良好的专业素养、丰富的工程管理经验和适应行业发展的能力，成为矿物及无机非金属材料相关企事业单位中的技术骨干或管理人才。

二、毕业要求

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、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，分析矿物及无机非金属材料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：能够设计针对矿物及无机非金属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矿物及无机非金属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，并用以辅助解决矿物及无机非金属材料相关实际工程问题。

6） 工程与社会：能够基于材料工程相关背景知识进行合理分析，评价专业工程实践和复杂工程问题解决方案对社会、健康、安全、法律以及文化的影响，并理解应承担的责任。

7） 环境和可持续发展：能够理解和评价针对矿物及无机非金属材料相关工程问题的专业工程实践对环境、社会可持续发展的影响。

8） 职业规范：具有人文社会科学素养、社会责任感，能够在工程实践中理解并遵守工程职业道德和规范，履行责任。

9）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。

10） 沟通：能够就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，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，掌握一门外语，能够在跨文化背景下进行沟通和交流。

11） 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。

12） 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。

三、主干学科

材料科学与工程。

四、学制与学位

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。

五、核心课程

专业核心课程：材料学概论、材料科学基础、材料工程基础、晶体学基础、量子与统计、固体物理、材料力学基础、材料物理、电工电子技术、工业矿物与岩石、材料现代测试技术、无机材料工艺学、硅酸盐材料学、矿物资源加工学、新型陶瓷材料、材料化学、材料基因工程导论、复合材料学、工业技术经济与环境保护、材料专业英语、材料生产设备与智能化和材料工厂设计与智能化制造概论等。

实践课程：实验与实践安全教育、实验物理、实验化学、晶体光学实验、金工实习、教学实习、专业实习、材料制备与性能实验、材料专业综合设计实验和毕业论文等。

Undergraduate Program in Materials Science and Engineering

1. 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.

2. 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 society: be able to conduct reasonable analysis based on engineering

background knowledge, evaluate the impact of solutions to engineering problems related to material physics 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 physics.

(8) Professional norms: with humanistic and social science literacy, social responsibility; be able to understand and abide by engineering professional ethics and norms in engineering practice, and fulfill corresponding responsibilities.

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

(10) 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.

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

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

3. Main disciplines

Materials science and Engineering.

4. 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.

5. Core Courses

Core Courses: Introduction to Materials Science, Fundamentals of Materials Science, Fundamentals of Materials Engineering, Basic course of crystallography, Quantum and Statistics（Applied Quantum and Statistical Physics）, Solid-state Physics, Fundamentals of Material Mechanics, Materials Physics, Electrical and Electronic Technology, Industrial Minerals and Rocks, Modern Techniques for Materials, Inorganic Materials Technology, Silicate Materials, Mineral Resources Processing, New Ceramic Materials, Material Chemistry, Introduction to Materials Genome Engineering, Composite Materials, Industrial Technology, Economy and Environmental Protection, Materials English, Introduction to Inorganic Nonmetallic Material Production Equipment and Introduction to design of production plant and intelligent manufacturing in materials, etc.

Practice: Experiment and practice safety, Physics Experiments, Chemistry Experiments, Crystal Optics Experiment, Metalworking Practice, Teaching Practice, Special Practice, Materials Preparation and Properties Experiment, Special Comprehensive Experiment and Graduation thesis.

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	746	41	12.25	14.25		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	192	12											
专业教育 Professional Education	学科基础课程 Disciplinary Fundamental Courses	936	58.5	13	9		15	14.5		4	3			
	专业核心课程 Specialized Fundamental Courses	496	31							19	12			
	专业拓展课程（选修） Specialized Development	64	4										4	
实践教育 Practical Education	课程实践 Course Practice	29 周 +272 学时	34	1	4	2	1	1	5		2	6	6	6
	课外实践 Extracurricular practice		6											
必修课总学分 Required course credits				164.5										
选修课总学分 Elective course credits				22										
最低毕业总学分 Total Credits				186.5										

七、分专业课程设置（Curriculum）

1、专业核心课程（Specialized Core Courses）：496 学时(496 hours)，31 学分(31Credits)

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
SR032015	材料物理 B Materials Physics B	48	3	40	8		考试 Exam	5	
SR033016	材料化学 B Materials Chemistry B	32	2	32			考试 Exam	5	
SR033011	材料工程基础 A Fundamentals of Materials Engineering A	48	3	48			考试 Exam	5	
SR033007	无机材料工艺学 Inorganic Materials Technology	48	3	48			考试 Exam	5	
SR033009	矿物资源加工学 Mineral Resources Processing	40	2.5	34	6		考试 Exam	5	
SR033008	硅酸盐材料学 Silicate Materials	48	3	48			考试 Exam	5	
SR033010	新型陶瓷材料 New Ceramic Materials	40	2.5	40			考试 Exam	5	
SR033104	材料基因工程导论 Introduction to Materials Genome Engineering	32	2	20	12		考试 Exam	6	
SR033105	材料生产设备与智能化 Industrial Equipment and Intelligent Manufacturing System in Materials	32	2	32			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	
SR033107	工业技术经济与环境保护 Industrial Technical Economics and Environmental Protection	32	2	32			考查 Term paper	6	
SR034014	材料专业英语 Specialized English for Materials Science	32	2	32			考试 Exam	6	
SR033056	复合材料学 B Composite Materials Sciences B	32	2	32			考查 Term paper	6	
总计 Total		496	31	470	26				

2、专业拓展课程（Specialized Development Courses）：选修 64 学时(64hours)，4 学分(4Credits)

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
SS030031	新型电池材料前沿问题及未来电池发展方向 Novel Electrode Materials for Advanced Batteries: Key Issues and Perspectives	16	1	16			考查 Term paper	7	
SS030032	新型功能矿物材料及其在能源、环境领域中的应用前沿 New functional mineral materials and their applications in energy and environmental fields	16	1	16			考查 Term paper	7	
SS030033	矿物材料及其复合材料的发展前景 The development prospects of mineral materials and their composite materials	16	1	16			考查 Term paper	7	
SS030034	纳米复合光催化材料及其环境能源应用 Nanocomposite photocatalytic materials and their applications in environmental and energy fields	16	1	16			考查 Term paper	7	
SS030035	先进薄膜材料 Advanced Thin Film Materials	16	1	16			考查 Term paper	7	
SS030069	固体废弃物资源材料化利用 Utilization of solid wastes in materials	16	1	16			考查 Term paper	7	
SS030072	新型功能陶瓷及应用 Frontiers in Inorganic Nonmetallic Materials	16	1	16			考查 Term paper	7	
SS030073	纳米科技 nanotechnology	16	1	16			考查 Term paper	7	
SS030074	柔性显示器件关键材料 Current status and future developing trends of key materials for flexible display devices	16	1	16			考查 Term paper	7	
SS034108	装饰文化与环境影响 Decoration culture and its environmental impact	32	2	32			考查 Term paper	2	
SS034109	新能源材料化学 New Energy Materials Chemistry	32	2	32			考查 Term paper	7	
SS034110	人工智能与材料 Artificial Intelligence and Materials	32	2	32			考查 Term paper	7	

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
SS034111	精细化学品化学 Fine Chemicals Chemistry	16	1	16			考查 Term paper	7	
SS034112	稀土纳米材料 Rare Earth Nanomaterials	16	1	16			考查 Term paper	7	
SS034113	催化化学 Catalysis Chemistry	16	1	16			考查 Term paper	7	
SS034114	仿生智能材料 Biomimetic smart materials	16	1	16			考查 Term paper	7	
SS034115	新型介电能源材料 New dielectric energy materials	16	1	16			考查 Term paper	7	

3、**课程实践**（Course Practice）：29 **周**+272 **学时** (29 Weeks and 272 Hours)，34 **学分** (34 Credits)

课程代码 Courses Code	课程名称 Courses Name	周数（学时） Weeks（hours）	学分 Credits	考核方式 Assessment	开课学期 Semester	备注 Notes
PR311003	军事技能训练 Military Theory and Practice	2 周	1	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	
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	
PR031116	材料实验与实践安全 Experiment and practice safety	24 学时	1	考试 Exam	2	
PR032117	晶体光学 Crystal Optics	24 学时	1	考试 Exam	4	
PR033036	材料制备与性能实验 (1) Materials Preparation and Properties Experiment (1)	48 学时	2	考查 Term paper	6	

课程代码 Courses Code	课程名称 Courses Name	周数（学时） Weeks（hours）	学分 Credits	考核方式 Assessment	开课学期 Semester	备注 Notes
PR033037	材料制备与性能实验 (2) Materials Preparation and Properties Experiment (2)	48 学时	2	考查 Term paper	7	
PR034038	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		29 周+272 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.

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					√
毕业要求12				√	

九、毕业要求与培养目标矩阵（工程教育认证类专业）

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) 工程与社会	(7) 环境和可持续发展	(8) 职业规范	(9) 个人和团队	(10) 沟通	(11) 项目管理	(12) 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)系列拓展课程									L	L		L
大学计算机					L							
程序设计基础 A					H							
高等数学 A(1)(2)	L											
线性代数	L											
概率论与数理统计	L											
大学物理(1)(2)	L											
工程图学	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) 工程与社会	(7) 环境和可持续发展	(8) 职业规范	(9) 个人和团队	(10) 沟通	(11) 项目管理	(12) 终身学习
无机化学	L											
分析化学基础	L											
有机化学 C	L											
物理化学 B	L											
材料类专业导论												H
晶体学基础	M	M										
材料学概论							M			M		M
工业矿物与岩石	H	H					H					
材料科学基础	H	M										
量子与统计	L											
材料现代测试技术				H	H							
固体物理	M											
材料力学基础	M	M		H		H						
电工电子技术 B				L	H							
材料物理 B	H	H										
材料化学 B	H	H										
材料工程基础 A	H		H								H	
无机材料工艺学		H	H			H						
矿物资源加工学	H		H									
硅酸盐材料学		H	M									
新型陶瓷材料				H								
材料基因工程导论				M	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) 工程与社会	(7) 环境和可持续发展	(8) 职业规范	(9) 个人和团队	(10) 沟通	(11) 项目管理	(12) 终身学习
材料生产设备与智能化			H			H						
材料工厂设计与智能化制造概论			H			M					H	
工业技术经济与环境保护						H	H				H	
材料专业英语										H		
复合材料学 B						H						
军事理论、军事技能训练									M			
思想政治社会实践									H			
实验物理(1)(2)					L							
实验化学					L							
材料实验与实践安全								H				
晶体光学					H							
材料制备与性能实验(1)(2)				H	M				H			M
材料专业综合设计实验		H	H	H	H				H	H		
金工实习						L						
教学实习			H			M						
专业实习						M					H	
毕业设计（论文）		H	H	H	H						H	H

注：H 表示课程对毕业要求指标支撑度高；M 表示课程对毕业要求指标支撑度中等；L 表示课程对毕业要求指标支撑度低。

材料物理专业培养方案

一、专业培养目标

材料物理专业以矿物功能材料为主要方向，以功能材料及器件的研发和应用为特色，重点发展矿物材料、薄膜材料、光电磁功能材料及相关环境和能源新材料等领域。本专业要培养具有良好的职业道德，掌握系统的专业理论知识和良好的人文科学素养，“品德优良、基础厚实、知识广博、专业精深”的高素质创新人才。本专业毕业的学生能够从事环境和能源材料领域中基础理论研究工作，从事新材料、新工艺、新技术开发和生产技术管理等工程科技工作和技术经济管理工作。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，了解国家关于新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）具有从事材料物理领域科学研究、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。

（3）熟悉专业方向的前沿和发展现状和趋势，具有所学专业方向材料制品的设计、制备、测试、分析和应用能力。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。

（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，具有终生学习能力。

二、毕业要求

本专业学生主要学习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。本专业毕业生应获得以下几个方面的知识、能力与素质：

（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材料物理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，分析材料物理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：能够设计针对材料物理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物理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物理相关实际工程问题。

（6）工程与社会：能够基于工程相关背景知识进行合理分析，评价材料物理相关工程问题解决方案对社会、健康、安全、法律以及文化的影响，并理解应承担的责任。

（7）环境和可持续发展：能够理解和评价针对材料物理相关工程问题的专业工程实践对环境、社会可持续发展的影响。

（8）职业规范：具有人文社会科学素养、社会责任感，能够在工程实践中理解并遵守工程职业道德和规范，履行责任。

（9）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。

（10）沟通：能够就材料物理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。

（11）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用。

（12）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。

三、主干学科

材料物理。

四、学制与学位

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。

五、核心课程

专业核心课程：功能材料导论，纳米材料，薄膜材料，新能源材料，波谱与能谱分析，复合材料学，计算材料学，材料物理 A，固体物理，半导体物理，材料物理专业英语，高分子物理，高分子化学，量子与统计，光电催化基础

实践课程：材料实验与实践安全、实验物理、实验化学、教学实习、金工实习、晶体光学、材料物理制备与性能实验、专业实习、材料物理专业综合实验、毕业设计（论文）。

Undergraduate Program in Materials Physics

1. Academic Objectives

Materials Physics combines the discipline advantages of our university, takes mineral functional materials as the main direction, and takes the research and application technology of functional materials and devices as its distinguishing feature, focusing on the development of mineral materials, thin film materials, optoelectronic and electromagnetic functional materials and related new materials for environmental and energy. It aims 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. The graduates of this major can engage in the basic theoretical research in environmental and energy materials, the development of new materials, new processes and new technologies, and the engineering science and technology and technical and economic management of production technology management.

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 mathematics and physics, professional knowledge and other related basic knowledge of natural science required for scientific research, engineering design and technical services in materials science and engineering.

(3) Be familiar with the frontier and 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, can effectively explore new materials, new processes, new technologies.

(4) Master the 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 using the knowledge learned.

(5) Have good oral and written expression and communication skills, organizational ability and strong team spirit, and lifelong learning ability.

2. Graduation Requirements

Students in this major mainly study materials physics of the basic theory and basic knowledge, accept basic training about the material preparation, structural analysis and performance test. Students should understand the basic rule about the relationship between the material composition and structure, preparation and processing technology and the material performance, and master the basic method of material design, preparation and process control. Graduates of this major should acquire the following knowledge, ability and quality:

(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 society: be able to conduct reasonable analysis based on engineering background knowledge, evaluate the impact of solutions to engineering problems related to material physics 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 physics.

(8) Professional norms: with humanistic and social science literacy, social responsibility; be able to understand and abide by engineering professional ethics and norms in engineering practice, and fulfill corresponding responsibilities.

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

(10) 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.

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

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

3. **Main disciplines**

Materials physics.

4. **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.

5. **Core Courses**

Specialized Core Courses: Introduction to Functional Materials, Nano-materials, Thin Film Materials, New Energy Materials, Spectral and energy spectrum analysis, Composite Materials Science, Computational Materials Science, Materials Physics, Solid Physics, Semiconductor Physics, Specialized English for Materials Physics, Polymer Physics, Polymer Chemistry, Quantum and Statistics, Fundamentals of Photoelectrocatalysis

Course Practice: Experiment and practice safety, Physics Experiments, Chemistry Experiments, Teaching Practice, Metalworking Practice, Crystal Optics, Materials Preparation and Properties Experiment, Professional Practice, Special Comprehensive Experiments, Graduation Design (Thesis)

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	746	41	12.25	14.25		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	192	12											
专业教育 Professional Education	学科基础课程 Disciplinary Fundamental Courses	936	58.5	13	9		15	14.5		4	3			
	专业核心课程 Specialized Fundamental Courses	480	30							15.5	14.5			
	专业拓展课程（选修） Specialized Development	64	4										4	
实践教育 Practical Education	课程实践 Course Practice	30 周 +224 学时	33	1	4	2	1	1	5	1	2	6	4	6
	课外实践 Extracurricular practice		6											
必修课总学分 Required course credits				162.5										
选修课总学分 Elective course credits				22										
最低毕业总学分 Total Credits				184.5										

七、分专业课程设置（Curriculum）

1、专业核心课程（Specialized Core Courses）：480 学时(480 hours)，30 学分(30Credits)

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
SR033024	材料工程基础 B Fundamentals of Materials Engineering B	32	2	32			考试 Exam	5	
SR033118	材料物理 A Materials Physics A	48	3	48			考试 Exam	5	
SR033019	高分子物理 Polymer Materials	32	2	32			考试 Exam	5	
SR033018	高分子化学 Polymer Chemistry	40	2.5	40			考试 Exam	5	
SR033119	半导体物理 Semiconductor Physics	32	2	32			考试 Exam	5	
SR033120	光电催化基础 Fundamentals of Photoelectrocatalysis	32	2	32			考查 Term paper	5	
SR033121	波谱与能谱分析 Spectral and energy spectrum analysis	32	2	32			考试 Exam	5	
SR033028	功能材料导论 Introduction to Functional Materials	32	2	32			考查 Term paper	6	
SR033029	纳米材料 Nano-materials	32	2	32			考查 Term paper	6	
SR033122	薄膜材料 Thin Film Materials	40	2.5	40			考查 Term paper	6	
SR033031	新能源材料 New Energy Materials	32	2	32			考查 Term paper	6	
SR033057	复合材料学 C Composite Materials Science C	32	2	32			考查 Term paper	6	
SR033033	计算材料学 Computational Materials Science	32	2	20	12		考试 Exam	6	
SR034035	材料物理专业英语 Specialized English for Materials Physics	32	2	32			考查 Term paper	6	
总计 Total		480	30	468	12				

2、专业拓展课程（Specialized Development Courses）：选修 64 学时(64hours)，4 学分(4Credits)

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
SS030031	新型电池材料前沿问题及未来电池发展方向 Novel Electrode Materials for Advanced Batteries: Key Issues and Perspectives	16	1	16			考查 Term paper	7	
SS030032	新型功能矿物材料及其在能源、环境领域中的应用前沿 New functional mineral materials and their applications in energy and environmental fields	16	1	16			考查 Term paper	7	
SS030033	矿物材料及其复合材料的发展前景 The development prospects of mineral materials and their composite materials	16	1	16			考查 Term paper	7	
SS030034	纳米复合光催化材料及其环境能源应用 Nanocomposite photocatalytic materials and their applications in environmental and energy fields	16	1	16			考查 Term paper	7	
SS030035	先进薄膜材料 Advanced Thin Film Materials	16	1	16			考查 Term paper	7	
SS030069	固体废弃物资源材料化利用 Utilization of solid wastes in materials	16	1	16			考查 Term paper	7	
SS030072	新型功能陶瓷及应用 Frontiers in Inorganic Nonmetallic Materials	16	1	16			考查 Term paper	7	
SS030073	纳米科技 nanotechnology	16	1	16			考查 Term paper	7	
SS030074	柔性显示器件关键材料 Current status and future developing trends of key materials for flexible display devices	16	1	16			考查 Term paper	7	
SS034108	装饰文化与环境影响 Decoration culture and its environmental impact	32	2	32			考查 Term paper	2	
SS034109	新能源材料化学 New Energy Materials Chemistry	32	2	32			考查 Term paper	7	
SS034110	人工智能与材料 Artificial Intelligence and Materials	32	2	32			考查 Term paper	7	

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
SS034111	精细化学品化学 Fine Chemicals Chemistry	16	1	16			考查 Term paper	7	
SS034112	稀土纳米材料 Rare Earth Nanomaterials	16	1	16			考查 Term paper	7	
SS034113	催化化学 Catalysis Chemistry	16	1	16			考查 Term paper	7	
SS034114	仿生智能材料 Biomimetic smart materials	16	1	16			考查 Term paper	7	
SS034115	新型介电能源材料 New dielectric energy materials	16	1	16			考查 Term paper	7	

3、**课程实践**（Course Practice）：30 **周**+224 **学时**（30 Weeks and 224 Hours），33 **学分**（33 Credits）

课程代码 Courses Code	课程名称 Courses Name	周数（学时） Weeks（hours）	学分 Credits	考核方式 Assessment	开课学期 Semester	备注 Notes
PR311003	军事技能训练 Military Theory and Practice	2 周	1	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	
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	
PR031116	材料实验与实践安全 Experiment and practice safety	24 学时	1	考试 Exam	2	
PR032117	晶体光学 Crystal Optics	24 学时	1	考试 Exam	4	
PR033048	材料工程基础课程设计 Course Design for Basis of Material Engineering	1 周	1	考查 Term paper	5	
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	

课程代码 Courses Code	课程名称 Courses Name	周数（学时） Weeks（hours）	学分 Credits	考核方式 Assessment	开课学期 Semester	备注 Notes
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	
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		30 周+224 学时	33			

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.

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			√	√	
毕业要求12				√	√

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) 工程与社会	(7) 环境和可持续发展	(8) 职业规范	(9) 个人和团队	(10) 沟通	(11) 项目管理	(12) 终身学习
思想道德与法治							L	H		L		
中国近现代史纲要								L				
马克思主义基本原理								M			L	M
毛泽东思想和中国特色社会主义理论体系概论							M	M				
习近平新时代中国特色社会主义思想概论								M			H	
形式与政策							L	M		H		
大学生职业生涯规划与就业指导(1)(2)									M			M
大学生心理素质教育(1)(2)										L		L
大学英语(1)(2)										H		L
大学英语素质拓展课										H		L
体育(1)(2)(3)(4)系列拓展课程									L			M
大学计算机	L				M							
程序设计基础 A	L		M		M				H			
高等数学 A(1)(2)	H	H		L								
线性代数	H	H		L								
概率论与数理统计	H	H		L								
大学物理(1)(2)	H			M								
工程图学			H		H	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) 工程与社会	(7) 环境和可持续发展	(8) 职业规范	(9) 个人和团队	(10) 沟通	(11) 项目管理	(12) 终身学习
分析化学基础	M			H								
无机化学	M			H								
有机化学 C	M			H								
物理化学 B	M			H								
材料类专业导论	M					M	L					
晶体学基础				H								
材料学概论	M						M					
工业矿物与岩石				H		M						
材料科学基础		H		H								
量子与统计	H			M								
材料现代测试技术					H							
固体物理				H								
材料力学基础	M	M		H		H						
电工电子技术 B				L	H							
材料工程基础 B	H		H	H		H						
材料物理 A	L	M	M	M	M			L		M		L
高分子物理			H	M								
高分子化学			H	M								
半导体物理	H	M		H	M		M					M
光电催化基础		M	M	H								
波谱与能谱分析		H		H	H							
功能材料导论	M	M	M	H	M							
纳米材料		M	M	H	M		H	M				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) 工程与社会	(7) 环境和可持续发展	(8) 职业规范	(9) 个人和团队	(10) 沟通	(11) 项目管理	(12) 终身学习
薄膜材料	H	M	M	M	M	M	M	M				M
新能源材料	M	L	L	M	M	M	H					
复合材料学 C				H				L				
计算材料学	L	H	M	H	M							
材料物理专业英语					H		H	H		H		
军事理论、军事技能训练								L	H			
思想政治社会实践						H			H	M		
实验物理(1)(2)	M				M							
实验化学	M				H							
材料实验与实践安全							M	H				
晶体光学					H							
材料工程基础课程设计												
材料物理制备与性能实验	L	L	L	M	H				M	M		
材料物理专业综合实验	M	H	H	H	M				M	M		
金工实习					H	L						
教学实习						M	M					L
专业实习		M	M			H						
毕业设计（论文）		H	H	H	H	M			M		L	M

注：H 表示课程对毕业要求指标支撑度高；M 表示课程对毕业要求指标支撑度中等；L 表示课程对毕业要求指标支撑度低。

材料化学专业培养方案

一、培养目标

材料化学专业以矿物高分子复合材料为主要方向，以新材料的研发和应用技术为特色，重点发展矿物材料、矿物高分子复合材料、纳米复合材料、固废资源材料化利用等领域。本专业要培养具有良好的职业道德，掌握系统的专业理论知识和良好的人文科学素养，“品德优良、基础厚实、知识广博、专业精深”的高素质创新人才。本专业毕业的学生能够从事矿物及其高分子复合材料领域中研究工作，从事新材料、新工艺、新技术开发和生产技术管理等工程科技工作和技术经济管理工作。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。

（3）熟悉专业方向的前沿和发展现状和趋势，具有所学专业方向材料制品的设计、制备、测试、分析和应用能力。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。

（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，具有终生学习能力。

二、毕业要求

材料化学专业以材料学、物理学、化学、数学为基础，系统学习材料化学专业的基础理论和实验技能，并将其应用于材料的设计、合成、制备、性能优化等方面的学科。本专业学生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）工程与社会：能够基于工程相关背景知识进行合理分析，评价材料化学和矿物及其高分子复合材料相关工程问题解决方案对社会、健康、安全、法律以及文化的影响，并理解应承担的责任。

（7）环境和可持续发展：能够理解和评价针对材料化学和矿物及其高分子复合材料相关工程问题的专业工程实践对环境、社会可持续发展的影响。

（8）职业规范：具有人文社会科学素养、社会责任感，能够在工程实践中理解并遵守工程职业道德和规范，履行责任。

（9）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。

（10）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。

（11）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。

（12）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。

三、主干学科

材料化学。

四、学制与学位

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。

五、核心课程

专业核心课程：材料学概论、材料科学基础、复合材料学、高分子材料、材料工程基础、晶体学基础、材料化学、固体物理、量子与统计、材料力学基础、材料物理、电工电子技术、材料现代测试技术、仪器分析、材料专业英语、结构化学、高分子化学、高分子物理、胶体与界面化学等。

实践课程：实验与实践安全教育、实验物理、实验化学、晶体光学、金工实习、教学实习、专业实习、材料制备实验、材料专业综合实验和毕业论文等。

Undergraduate Program in Materials chemistry

1. Academic Objectives

Materials chemistry combines the discipline advantages of our university, takes the research and application technology of new mineral materials and their composite materials as its distinguishing feature. It aims 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. The graduates of this major can engage in the basic theoretical research in mineral and polymer composite materials, the development of new materials, new processes and new technologies, and the engineering science and technology and technical and economic management of production technology management. 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 mathematics and physics, professional knowledge and other related basic knowledge of natural science required for scientific research, engineering design and technical services in materials science and engineering.

(3) Be familiar with the frontier and 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, can effectively explore new materials, new processes, new technologies.

(4) Master the 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 using the knowledge learned.

(5) Have good oral and written expression and communication skills, organizational ability and strong team spirit, and lifelong learning ability.

2. 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) Professional norms: with humanistic and social science literacy, social responsibility; be able to understand and abide by engineering professional ethics and norms in engineering practice, and fulfill corresponding responsibilities.

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

(10) 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.

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

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

3. Main disciplines

Materials chemistry.

4. 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.

5. Core Courses

Core Courses: Introduction to Materials Science, Fundamentals of Materials Science, Composite Materials Science, Fundamentals of Materials Engineering, Basic course of crystallography, Quantum and Statistics, Solid-state Physics, Fundamentals of Material Mechanics, Materials Physics, Electrical and Electronic Technology, Modern Techniques for Materials, Material Chemistry, Composite Materials, Structural Chemistry, Polymer Chemistry, Polymer Physics, Polymer Materials, Instrumental Analysis, Composite Materials Sciences, Colloids and Interfaces Chemistry, Specialty English for Materials Chemistry, etc.

Practice: Experiment and practice safety, Physics Experiments, Chemistry Experiments, Crystal Optics Experiment, Metalworking Practice, Teaching Practice, Special Practice, Materials Preparation Experiment, Special Comprehensive Experiment and Graduation thesis.

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	746	41	12.25	14.25		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	192	12											
专业教育 Professional Education	学科基础课程 Disciplinary Fundamental Courses	936	58.5	13	9		15	14.5		4	3			
	专业核心课程 Specialized Fundamental Courses	440	27.5							16.5	11			
	专业拓展课程（选修） Specialized Development	64	4										4	
实践教育 Practical Education	课程实践 Course Practice	29 周 +224 学时	32	1	4	2	1	1	5	1	2	6	3	6
	课外实践 Extracurricular practice		6											
必修课总学分 Required course credits				159										
选修课总学分 Elective course credits				22										
最低毕业总学分 Total Credits				181										

七、分专业课程设置（Curriculum）

1、专业核心课程（Specialized Core Courses）：440 学时(440hours)，27.5 学分(27.5Credits)

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
SR033024	材料工程基础 B Fundamentals of Materials Engineering B	32	2	32			考试 Exam	5	
SR032023	材料物理 C Materials Physics C	32	2	32			考试 Exam	5	
SR033017	结构化学 Structural Chemistry	32	2	32			考试 Exam	5	
SR033018	高分子化学 Polymer Chemistry	40	2.5	40			考试 Exam	5	
SR033019	高分子物理 Polymer Physics	32	2	32			考试 Exam	5	
SR033020	材料化学 A Materials Chemistry A	48	3	48			考试 Exam	5	
DR033005	仪器分析 Instrumental Analysis	48	3	48			考试 Exam	5	
SR033021	高分子材料 Polymer Materials	32	2	32			考试 Exam	6	
SR033055	复合材料学 A Composite Materials Sciences A	48	3	48			考试 Exam	6	
SR033026	胶体与界面化学 Colloid and Interface Chemistry	32	2	24	8		考试 Exam	6	
SR034027	材料化学专业英语 Specialized English for Materials Chemistry	32	2	32			考查 Term paper	6	
SR033033	计算材料学 Computational Materials Science	32	2	20	12		考试 Exam	6	
总计 Total		440	27.5	420	20				

2、专业拓展课程（Specialized Development Courses）：选修 64 学时(64hours)，4 学分(4Credits)

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
SS030031	新型电池材料前沿问题及未来电池发展方向 Novel Electrode Materials for Advanced Batteries: Key Issues and Perspectives	16	1	16			考查 Term paper	7	
SS030032	新型功能矿物材料及其在能源、环境领域中的应用前沿 New functional mineral materials and their applications in energy and environmental fields	16	1	16			考查 Term paper	7	
SS030033	矿物材料及其复合材料的发展前景 The development prospects of mineral materials and their composite materials	16	1	16			考查 Term paper	7	
SS030034	纳米复合光催化材料及其环境能源应用 Nanocomposite photocatalytic materials and their applications in environmental and energy fields	16	1	16			考查 Term paper	7	
SS030035	先进薄膜材料 Advanced Thin Film Materials	16	1	16			考查 Term paper	7	
SS030069	固体废弃物资源材料化利用 Utilization of solid wastes in materials	16	1	16			考查 Term paper	7	
SS030072	新型功能陶瓷及应用 Frontiers in Inorganic Nonmetallic Materials	16	1	16			考查 Term paper	7	
SS030073	纳米科技 nanotechnology	16	1	16			考查 Term paper	7	
SS030074	柔性显示器件关键材料 Current status and future developing trends of key materials for flexible display devices	16	1	16			考查 Term paper	7	
SS034108	装饰文化与环境影响 Decoration culture and its environmental impact	32	2	32			考查 Term paper	2	
SS034109	新能源材料化学 New Energy Materials Chemistry	32	2	32			考查 Term paper	7	
SS034110	人工智能与材料 Artificial Intelligence and Materials	32	2	32			考查 Term paper	7	

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
SS034111	精细化学品化学 Fine Chemicals Chemistry	16	1	16			考查 Term paper	7	
SS034112	稀土纳米材料 Rare Earth Nanomaterials	16	1	16			考查 Term paper	7	
SS034113	催化化学 Catalysis Chemistry	16	1	16			考查 Term paper	7	
SS034114	仿生智能材料 Biomimetic smart materials	16	1	16			考查 Term paper	7	
SS034115	新型介电能源材料 New dielectric energy materials	16	1	16			考查 Term paper	7	

3、**课程实践**（Course Practice）：29 **周**+224 **学时**（29 Weeks and 224 Hours），32 **学分**（32 Credits)

课程代码 Courses Code	课程名称 Courses Name	周数（学时） Weeks（hours）	学分 Credits	考核方式 Assessment	开课学期 Semester	备注 Notes
PR311003	军事技能训练 Military Theory and Practice	2 周	1	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	
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	
PR031116	材料实验与实践安全 Experiment and practice safety	24 学时	1	考试 Exam	2	
PR032117	晶体光学 Crystal Optics	24 学时	1	考查 Term paper	4	
PR033048	材料工程基础课程设计 Course Design for Basis of Material Engineering	1 周	1	考查 Term paper	5	

课程代码 Courses Code	课程名称 Courses Name	周数（学时） Weeks（hours）	学分 Credits	考核方式 Assessment	开课学期 Semester	备注 Notes
PR033044	材料制备实验 Preparation of Materials	48 学时	2	考查 Term paper	6	
PR034045	材料化学专业综合实验 Special Comprehensive Experiments	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	
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		29 周+224 学时	32			

4、课外实践（Extracurricular practice）

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.

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				√	
毕业要求12					√

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) 工程与社会	(7) 环境和可持续发展	(8) 职业规范	(9) 个人和团队	(10) 沟通	(11) 项目管理	(12) 终身学习
思想道德与法治							L	H		L		
中国近现代史纲要								L				
马克思主义基本原理								M			L	M
毛泽东思想和中国特色社会主义理论体系概论							M	M				
习近平新时代中国特色社会主义思想概论								M			H	
形式与政策							L	M		H		
大学生职业生涯规划与就业指导(1)(2)									M			M
大学生心理素质教育(1)(2)										L		L
大学英语(1)(2)										H		L
大学英语素质拓展课										H		L
体育(1)(2)(3)(4)系列拓展课程									L			M
大学计算机	L				M							
程序设计基础 A	L		M		M				H			
高等数学 A(1)(2)	H	H		L								
线性代数	H	H		L								
概率论与数理统计	H	H		L								
大学物理(1)(2)	H			M								
工程图学			H		H	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) 工程与社会	(7) 环境和可持续发展	(8) 职业规范	(9) 个人和团队	(10) 沟通	(11) 项目管理	(12) 终身学习
分析化学基础	M			H								
无机化学	M			H								
有机化学 C	M			H								
物理化学 B	M			H								
材料类专业导论	M					M	L					
晶体学基础				H								
材料学概论	M						M					
工业矿物与岩石				H		M						
材料科学基础		H		H								
量子与统计	H			M								
材料现代测试技术					H							
固体物理				H								
材料力学基础	M	M		H		H						
电工电子技术 B				L	H							
材料工程基础 B	H		H	H		H						
材料物理 C					M							
结构化学				H	M							
高分子化学	H			H								
高分子物理	H			H								
材料化学 A				H		L						
仪器分析		H		H	H			L				
高分子材料			H				M					
精细化学品化学	H	H					M	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) 工程与社会	(7) 环境和可持续发展	(8) 职业规范	(9) 个人和团队	(10) 沟通	(11) 项目管理	(12) 终身学习
复合材料学 A				H				L				
胶体与界面化学	H	H		H								
材料化学专业英语				H	M							M
计算材料学				H	H							
军事理论、军事技能训练								L	H			
思想政治社会实践						H			H	M		
实验物理(1)(2)	M				M							
实验化学	M				H							
材料实验与实践安全							M	H				
晶体光学					H							
材料工程基础课程设计		M	H		M							
材料制备实验				M	H				M	L		
材料化学专业综合实验		M	H	H	M			M		L		
金工实习					H	L						
教学实习						M	M					L
专业实习		M	M			H						
毕业设计（论文）		H	H	H	H	M			M		L	M

注：H 表示课程对毕业要求指标支撑度高；M 表示课程对毕业要求指标支撑度中等；L 表示课程对毕业要求指标支撑度低。