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)：730 **学时** (730Hours)，41 **学分** (40Credits)

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		730	41	492	222	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培养方案

一、培养目标

材料科学与工程专业以新型矿物材料的研发和应用为特色，重点发展矿物资源及工业固体废弃物利用、矿物加工、陶瓷和耐火材料等方向。本专业要培养面向国家战略需求，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，能够胜任材料工程及相关领域的技术、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”的材料科学与工程高素质创新人才。

本专业学生毕业 5 年左右，预期达到以下目标：

1） 知识更新：能够持续学习和及时更新知识，有丰富的专业知识和管理知识，适应岗位工作和事业发展要求。

2） 职业能力：具有缜密的综合分析能力、较强的材料专业技术能力和创新能力，能够独立解决材料领域复杂工程问题，并能够综合社会、环境、能耗、安全、经济成本、可持续发展等因素，做出合理决策，能够担当材料工程师、技术主管和项目负责人等工作。

3） 团队能力：有较强的团队合作能力和组织协调能力，能够胜任项目或团队管理工作，担任项目或团队负责人。

4） 竞争能力：具有前瞻性、较宽的国际视野和竞争意识，能够把握材料行业及其技术发展趋势，适应科学、技术、工程、环境和社会经济的新发展，在跨文化背景下开展交流、合作与竞争。

5） 人格与修养：具有良好的道德修养和职业精神、较强的社会责任感，人格健全，身心健康，热爱国家，爱岗敬业。

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

Materials Science and Engineering is characterized by research, development, and application of new mineral materials, which focuses on the exploitation of mineral resources, utilization of industrial solid waste, mineral processing, and preparation of ceramics and refractory materials. The major of Materials Science and Engineering aims to cultivate high-qualified and innovative talents to meet the national strategic needs of the country and accommodate the future development direction. Equipping them with the basic training of material engineers, basic theories, methods, and skills of this major so that they can be competent in the technology, management, research, and development of material engineering even other related fields. Training them to be outstanding students with comprehensive development in morals, intelligence, sports, aesthetics, and labour education who have strong ability of practice, innovation and entrepreneurship, a certain international perspective, and sustainable development potential.

Following objectives are expected to be achieved around 5 years after the graduation of the students in this major:

1) Knowledge updating: Learn and update knowledge continuously in time, have rich professional knowledge and management knowledge, be adapt to the job and career development requirements.

2) Vocational ability: Be able to solve complex engineering problems independently in the field of materials, have the ability of careful comprehensive analysis, strong professional technical and innovation. Make reasonable decisions with comprehensive consideration in society, environment, energy consumption, safety, economic costs, sustainable development, and other factors. Work as materials engineers, technical supervisors, and project leaders.

3) Team ability: Have strong teamwork ability, organization and coordination ability, and be competent for the project or team leaders in management work.

4) Competitiveness: Have a forward-looking, broad international vision and sense of competition, be able to grasp the development trend of the material industry and technology, accommodate the new development of science, technology, engineering, environment, and social economy. Carry out communication, cooperation, and competition in a cross-cultural background.

5) Personality and accomplishment: Have good moral cultivation and professionalism, a strong sense of social responsibility, a sound personality, physical and mental health, love our country, cherish posts and devote wholeheartedly to work.

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	730	41	11.25	13.25	1	4.25	5.25		3.25	1.25		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		4	4	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							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	M			H		M						
材料科学基础		H		H								
量子与统计				H								
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							
材料物理 B				H	M							
材料化学 B				H		L						
材料工程基础 A	H		H			H						
无机材料工艺学	H	H	H	H		H						
矿物资源加工学	H			H		H	M					
硅酸盐材料学	M			L				L				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
新型陶瓷材料	M			H				L				
材料基因工程导论				H	H							
材料生产设备与智能化		H	H	H		H						
材料工厂设计与智能化制造概论		H	H			H	M	L	M	M	H	
工业技术经济与环境保护		H	H	H		H	H	L				
材料专业英语				H	M							M
复合材料学 B				H				L				
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							
材料制备与性能实验(1)(2)				M	H				M	L		
材料专业综合设计实验		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。

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	730	41	11.25	13.25	1	4.25	5.25		3.25	1.25		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		4	4	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	730	41	11.25	13.25	1	4.25	5.25		3.25	1.25		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		4	4	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	2	考查 Term Paper	1 夏	
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。

新能源材料与器件专业培养方案

一、培养目标

本专业紧密对接国家“双碳”战略目标和新能源产业发展重大需求，聚焦新能源材料与器件的前沿领域，重点发展电化学能量存储与转化、高效太阳能电池技术、光电催化与绿色氢能、新型储能材料与器件等特色方向。本专业旨在培养践行社会主义核心价值观，具备扎实数理基础、系统专业知识、卓越工程实践能力与全面人文科学素养，“品德优良、基础厚实、知识广博、专业精深”的高素质创新人才。

经过五年左右的实践，本专业毕业生应达到以下目标：

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. 掌握从事新能源材料与器件领域科学研究、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学科知识，具有新能源材料合成、器件制备、性能测试等研发能力，并能够运用所学知识综合分析和解决工程实际问题。

3. 能够胜任光伏发电、新型储能、氢能开发等领域工程师以及相关技术主管和项目负责人等工作，并能够主动考虑安全、环境、行业标准、经济性等因素的制约与影响。

4. 熟悉专业方向的前沿和发展现状和趋势，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。

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

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。

毕业生应该获得以下几方面的知识和能力：

(1) 工程知识：具有数学、自然科学、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基本原理，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、维护中的工程问题，得到有效结论。

(3) 设计/开发解决方案：针对光伏、氢能、电化学储能、新型储能等领域复杂工程问题，能够制定解决方案，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意识，同时考虑社会、健康、安全、法律、文化以及环境等因素的影响。

(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，包括提出设计解决方案、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，以及撰写研究论文或报告。

(5) 使用现代工具：能够针对太阳能、氢能、电化学储能、新型储能、综合能源利用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) 工程与社会：能够运用工程理论及相关背景知识，分析、评价专业工程实践和复杂工程问题的解决方案对社会、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：了解环境保护和可持续发展的理念和内涵，能够理解和评价太阳能、氢能、电化学储能、智慧综合能源利用等领域工程实践对环境、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和社会责任感，能够在太阳能、电化学储能、氢能、新型储能、智慧综合能源利用等工程实践中理解并遵守职业道德和规

范，履行责任。

(9) 个人和团队：能够在材料、化工、电气等多学科交叉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：能够针对新能源领域的基本科学问题和复杂工程问题，与业界同行和社会公众进行有效沟通和交流，包括设计文稿、撰写报告、陈述发言、清晰表达或回应指令，并具备一定的国际视野，能够在跨文化背景下进行基本的沟通和交流。

(11) 项目管理：理解并掌握工程管理原理，并能够在多学科环境下应用。

(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

新能源材料与器件

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、晶体学基础、量子与统计、物理化学、电化学原理、半导体物理、材料现代测试技术、新能源材料专业英语、新能源材料、材料基因工程导论、能源转换与存储技术、太阳能电池原理与设计等。

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

Undergraduate Program in New Energy Materials and Devices

1. Academic Objectives

This program strategically aligns with China's "Dual Carbon" goals and addresses critical demands in the new energy sector, concentrating on cutting-edge domains of energy materials and devices. It prioritizes the advancement of distinctive fields including electrochemical energy storage/conversion systems, high-efficiency solar cell technologies, photo(electro)catalysis for green hydrogen production, and novel energy storage materials/devices. The program aims to cultivate high-caliber innovators who embody socialist core values, possessing rigorous mathematical-scientific foundations, systematic professional knowledge, outstanding engineering competencies, and comprehensive humanistic literacy, ultimately developing talents characterized by "moral integrity, robust foundational knowledge, extensive interdisciplinary expertise, and specialized technical excellence."

After approximately five years of professional engagement, graduates of this program are expected to achieve the following objectives:

(1) Demonstrate physical-mental wellness, moral integrity, and exemplary professional ethics, coupled with a strong sense of social responsibility and innovative aptitude. Maintain comprehensive awareness of national policies, regulations, and strategic directives governing materials science development, while upholding rigorous safety protocols, environmental stewardship, and sustainable development consciousness.

(2) Possess robust foundational knowledge in mathematics, core disciplinary principles, and interdisciplinary sciences essential for research, engineering design, and technical services in the new energy materials and devices sector. Develop advanced research and development competencies in energy material synthesis, device fabrication, and performance characterization, with demonstrated ability to holistically analyze and resolve complex engineering challenges using integrated knowledge frameworks.

(3) Exhibit readiness to serve as engineers, technical supervisors, or project leaders in photovoltaic systems, advanced energy storage, hydrogen energy development, and related fields. Proactively address multifactorial constraints in engineering practice, including safety imperatives, environmental impact mitigation, compliance with industry standards, and economic feasibility optimization.

(4) Maintain up-to-date mastery of emerging trends and cutting-edge advancements within the discipline. Cultivate systematic innovation capabilities to pioneer novel materials, refine manufacturing processes, and develop transformative technologies through methodical exploration and experimentation.

(5) Display exceptional oral/written communication proficiency and cross-functional collaboration skills. Demonstrate organizational acumen, team leadership aptitude, and commitment to continuous professional development through self-directed lifelong learning initiatives.

2. Graduation Requirement

The major of New Energy Materials and Devices is built on the foundations of materials science, physics, chemistry, and mathematics, encompassing the fundamental theories and experimental skills. Students in this program will master the basic theories and knowledge of new energy materials and devices, receive training in material preparation, structural analysis, and performance testing, and understand the fundamental principles governing the relationships between material composition, structure, synthesis, processing, and material properties. They will acquire essential methods for material design, preparation, modification, and characterization, and develop solid practical skills to meet the broad demands of new energy materials and devices and related fields.

Graduates should acquire the following knowledge and abilities:

(1) Engineering Knowledge: be able to possess knowledge in mathematics, natural sciences, engineering fundamentals, and specialized fields, and apply this knowledge to solve complex engineering problems in the development and service processes of new energy materials and devices.

(2) Problem Analysis: Be able to apply fundamental principles of mathematics, natural sciences, and engineering sciences, combined with literature research, to identify, articulate, and analyze engineering problems in the design, preparation, testing, and maintenance of new energy materials and devices, and to draw valid conclusions.

(3) Design/Development of Solutions: Be capable of formulating solutions for complex engineering problems in the fields of photovoltaic, hydrogen energy, electrochemical energy storage, and new types of energy storage. Be able to design materials and devices, technologies, and process flows that meet specific requirements, incorporating a sense of innovation in the design. Additionally, taking into account the impacts of social, health, safety, legal, cultural, and environmental factors.

(4) Research: Based on fundamental professional theories and employing reasonable research methods and approaches, the students should be capable of conducting research on engineering issues related to new energy materials and devices. This includes proposing design solutions, implementing experimental plans, collecting experimental data, analyzing and interpreting experimental results, drawing reasonable and effective conclusions, as well as writing research papers or reports.

(5) Use of Modern Tools: Be capable of selecting, developing, and utilizing appropriate technologies, resources, modern engineering tools, and information technology tools to address

complex engineering problems in the fields of solar energy, hydrogen energy, electrochemical energy storage, new types of energy storage, and comprehensive energy utilization. Be able to predict and simulate complex engineering issues while understanding the limitations of these tools.

(6) Engineering and Society: Be able to apply engineering theories and relevant background knowledge to analyze and evaluate the impacts of engineering practices and solutions to complex engineering problems on society, health, safety, law, and culture, and be able to understand the responsibilities that should be undertaken.

(7) Environment and Sustainable Development: Be able to understand the concepts and implications of environmental protection and sustainable development, and comprehend and evaluate the impacts of engineering practices in the fields of solar energy, hydrogen energy, electrochemical energy storage, and smart integrated energy utilization on environmental and social sustainable development.

(8) Professional Ethics: Be able to possess a foundation in the humanities and social sciences and a sense of social responsibility. Be able to understand and adhere to professional ethics and standards in engineering practices such as solar energy, electrochemical energy storage, hydrogen energy, new types of energy storage, and smart integrated energy utilization, and fulfill responsibilities accordingly.

(9) Individuals and Teams: Be able to assume roles as individuals, team members, and leaders within multidisciplinary teams involving materials, chemical engineering, electrical engineering, and other fields.

(10) Communication: Be able to effectively communicate and exchange ideas with industry peers and the general public on fundamental scientific issues and complex engineering problems in the field of new energy. This includes drafting design documents, writing reports, delivering presentations, clearly expressing or responding to instructions, and possessing a certain level of international perspective to engage in basic communication and exchange in cross-cultural contexts.

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

(12) Lifelong Learning: Be aware of self-directed and lifelong learning, and the ability to continuously learn and adapt to development.

3. Main disciplines

New Energy Materials and Devices.

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, Basic Course of Crystallography, Quantum and Statistics, Physical Chemistry, Principles of Electrochemistry, Semiconductor Physics, Modern Techniques for Materials Characterization, Specialized English for New Energy Materials and Devices, New Energy Materials, Introduction to Materials Genome Engineering, Energy Conversion and Storage Technology, Principles and Design of Solar Cells, etc.

Practice: Experiment and Practice Safety, Physics Experiments, Chemistry Experiments, Metalworking Practice, Teaching Practice, Professional Practice, Preparation and Property of New Energy Materials, Comprehensive Experiment of New Energy Materials and Devices, Graduation Design (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	730	41	11.25	13.25	1	4.25	5.25		3.25	1.25		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	288	18							8	10			
	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		2	6	4	6
	课外实践 Extracurricular practice		6											
必修课总学分 Required course credits				149.5										
选修课总学分 Elective course credits				22										
最低毕业总学分 Total Credits				171.5										

七、分专业课程设置（Curriculum）

1、专业核心课程（Specialized Core Courses）：288学时(288 hours)，18学分(18 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
SR033119	半导体物理 Semiconductor Physics	32	2	32			考试 Exam	5	
SR033016	材料化学 B Materials Chemistry B	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	
SR033104	材料基因工程导论 Introduction to Materials Genome Engineering	32	2	20	12		考试 Exam	6	
SR033031	新能源材料 New Energy Materials	32	2	32			考查 Term paper	6	
SR033131	能源转换与存储技术 Energy Conversion and Storage Technology	32	2	32			考查 Term paper	6	
SR033132	太阳能电池原理与设计 Principles and Design of Solar Cells	32	2	32			考试 Exam	6	
SR033133	新能源材料专业英语 Specialized English for New Energy Materials and Devices	32	2	32			考试 Exam	6	
总计 Total		288	18	276	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	

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
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	
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	

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
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	
PR033140	新能源材料与器件制备及性能实验 Preparation and Property of New Energy Materials	48 学时	2	考查 Term paper	6	
PR033141	新能源材料与器件专业综合实验 Comprehensive Experiment of 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	
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	
PR034143	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）：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				√	

在相应的毕业要求与培养目标里划 √

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							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	
形势与政策							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						
无机化学	M			H								
分析化学基础	M			H								
有机化学 C	M			H								
物理化学 B	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
材料类专业导论	M					M	L					
晶体学基础		M		H								M
材料学概论	M						M					
工业矿物与岩石	M			H		M						
材料科学基础	H	H		H								
量子与统计	L	H		H								M
材料现代测试技术				H	H							
固体物理	M			H								
材料力学基础	M	M		H		H						
电工电子技术 B				L	H							
半导体物理	H	M		H	M		M					M
材料化学 B	M			H								
材料工程基础 B	H		H								H	
材料基因工程导论				H	H							
电化学原理	H	M	H	M								
新能源材料	M	L	L	M	M	M	H					
能源转换与存储技术				H			H					
太阳能电池原理与设计			H			H	H					
新能源材料专业英语										H		
军事理论、军事技能训练								L	H			
思想政治社会实践									H	M		
实验物理（1）(2）	M				M							
实验化学	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
材料实验与实践安全							M	H				
晶体光学					H							
新能源材料与器件专业综合实验			H	H	M				H			M
新能源材料与器件制备及性能实验			H	H	M			L	H	H	H	
金工实习					H	L						
教学实习			H			M	M					
专业实习		M	M			H					H	
毕业设计（论文）		H	H	H	H	M		M	M		L	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。