目　　录
Contents

三、师范生免费教育有关政策及资料

材料化学
Material Chemistry

一、培养目标
I.Educational Objectives

本专业培养适应社会需求、德智体美全面发展、较系统掌握材料科学和化学的基本理论、了解材料应用背景和要求、具有较强实验能力和创新精神的应用型人才。所培养的本科毕业生既适宜于在科研机构和高等院校继续攻读材料科学、材料工程、化学及相关交叉学科进行深造，为材料和相关学科的基础及应用研究提供后备人才；也适宜于到高新技术产业部门、大型公司、政府部门等单位从事技术开发、应用性研究以及管理工作。

The program is designed to train applied talents with full development in morality, wisdom, physique and aesthetics; with positive world view, philosophy and value view; with solid foundation of natural science; with basic theory knowledge and techniques of material science and chemistry. The students will be trained with professional theories and techniques. The graduates will be candidates to study further in material science, material engineering, chemistry and relative inter-disciplinarity, or engaged in science research on material science and related fields, as well as technical exploitation, teaching and administration in institute, company and government departments.

二、培养要求
II.Educational Requirements

要求学生系统扎实地掌握数学、物理和化学基础；掌握材料科学和化学的基本理论、基本思路和基本方法；了解材料科学的发展趋势；在材料制备、材料表征和材料性能等三方面受到系统实验训练；熟练掌握英语，能够阅读本学科英文文献；熟悉科学研究方法，具有初步从事材料研究及应用的能力。

毕业生应获得以下几个方面的知识和能力：

1.有较扎实的自然科学基础，较好的人文、艺术和社会科学素养；

2.掌握材料学及相关学科宽广的基础理论，主要包括五大化学（无机化学、分析化学、有机化学、物理化学（含结构化学）及高分子化学）、普通物理、高等数学、材料科学与工程基础、功能材料、材料分析与表征原理、材料物理性能测试原理等基础知识和基本理论；

3.具有本专业必需的材料合成与表征技能；计算、测试、文献检索及论文写作能力；计算机和英语应用能力；

4.具有在无机功能材料，有机功能材料，高分子材料，液晶化学和纳米材料等专业领域所必需的专业知识，熟悉其应用、了解其相关领域科学前沿和发展趋势；

5.具有较强的自学能力、分析解决问题的能力、富有创新意识和较高的综合素质。

This program is designed to help students develop the knowledge and capabilities about mathematic, physics, chemistry, theories and methods about material science and chemistry and trend in material science development. The students will be trained in experiments of material preparation, material characterization and material performances. After graduation, the students can read specialty literatures in English, and be familiar to scientific research methods, and have ability to apply knowledge in practice.

After the end of the 4 years' study, students should have the capacities and knowledge as follows:

1.A grasp of the fundamental knowledge of natural science, attainment in humanities and art, cooperative and organizational skills.

2.Sound grounding in basic theories about material science and related disciplines, including inorganic chemistry, analysis chemistry, organic chemistry, physic chemistry (structural chemistry), polymer chemistry,

general physics, advanced mathematics, fundamentals of materials science and engineering, functional materials, principles and basic theories of material analysis and characterization.
3.A good command of techniques in material synthesis and characterization, ability to do documentary search, data query and thesis writing, skills to use English language.
4.Fundamental knowledge in inorganic functional materials, organic functional materials, polymer functional materials, liquid crystal chemistry and nanomaterials, skills to understand the development and trend in the discipline.
5.Ability of self-study, being able to explore, think and practice initiatively.

三、主干学科

Ⅲ. Core Disciplines

化学、材料科学与工程。

Chemistry, Materials Science and Engineering.

四、主干课程

IV.Primary Courses

高等数学、普通物理、无机化学、分析化学、有机化学、物理化学、结构化学、材料科学与工程基础、功能材料、无机材料合成化学、材料表征技术、材料物理性能学、纳米材料等。

Advanced Mathematics, General Physics, Inorganic chemistry, Analysis Chemistry, Organic Chemistry, Physic Chemistry, Structure Chemistry, Fundamentals of Materials Science and Engineering, Functional Materials, Synthetic Chemistry of Inorganic Materials, Analytical Techniques of Materials, Experiments in Physical Properties and Micro-structure of Materials, Nanomaterials.

五、学制

Ⅴ.Schooling System

学制 4 年

Four years

六、学分要求

VI.Total Credit

156.5 学分

156.5 credits

七、授予学位

Ⅶ.Degree Granting

理学或工学学士

Bachelor of Engineering

八、课程设置及学分、学时比例

Ⅷ.Syllabus and Credits/Hours Allocation

课程类别 Course Catalogue		学分及比例 Credits and Percentage			
		学分 Credits	小计 Sub-Total	占总学分比例 Percentage in Total Credits	小计 Sub-Total
通识教育模块 Liberal Studies Courses	通识教育必修课 Liberal Studies Compulsory Courses	39	47	24.92%	30.03%
	通识教育选修课 Liberal Studies Elective Courses	8		5.11%	
学科基础模块 Disciplinary Foundation Courses	相关学科基础课 Related Disciplinary Foundation Courses	16.5	22.5	10.54%	14.38%
	本学科基础课 Disciplinary Foundation Courses	6		3.83%	
专业课程模块 Specialized Courses	专业必修课 Specialized Compulsory Courses	38.5	54.5	24.6%	34.82%
	专业限定选修课 Specialized Restrictive Elective Courses	8		5.11%	
	专业任意选修课 Specialized Non-restrictive Elective Courses	8		5.11%	
专业技能模块 Professional Skills Courses	必修课 Compulsory Courses	21.5	21.5	13.74%	13.74%
	选修课 Elective Courses	0		0%	
实践模块 Practice Work	必修课 Compulsory Courses	11	11	7.03%	7.03%
合计 Total		156.5		100%	
说明 Notes	1.专业必修课（含学科基础课程）共 30 门。 2.专业选修课共 11 门，其中限定选修课 5 门，分 5 个系列（方向）；任意选修课 6 门。学生应从限定选修课中至少选修 8 学分，从任意选修课中至少选修 8 学分。 3.实验课程共 11 门，其中独立开设的实验课 10 门，既有理论又有实验的课程 1 门，含综合性、设计性实验的课程 2 门，占实验课程总数的 18.2%。 1. There are 30 compulsory courses of specialty including foundation courses in total. 2. There are 11 selective courses of specialty in total, including 5 of restrictive selective courses and 6 of free selective courses. Students should obtain 8 credits in restrictive selective courses, and 8 credits in free selective courses. 3. There are 11 experimental courses in total, including 10 of independent experimental courses and 1 of experiment which combines theory and practice. There are 2 comprehensive and designing experiments, which are 18.2% in total experimental courses.				

九、材料化学本科教学计划表

IX.Teaching Scheme for Material Chemistry Undergraduate Candidates

（一）通识教育模块（47 学分）

(Ⅰ) Liberal Studies Courses (47 credits)

1.通识教育必修课（39 学分）

1.Liberal Studies Compulsory Courses (39 credits)

课程编码 Courses Code	课程名称 Courses Name	开课学期 Semester	学分 Cre.	讲授学时 Teaching Hrs.	实验/实践学时 Experiment/ Training Hrs.	周学时 Weekly Hrs.	考试方式 Evaluation
1711001	思想道德修养与法律基础 The Ideological and Moral Cultivation and Fundamentals of Law	1	3	36	18	3	考试 Exam.
0111002	中国近现代史纲要 Outline of Modern and Contemporary Chinese History	1	2	27	9	2	考试 Exam.
0111003	马克思主义基本原理概论 Principles of Marxism	3	3	36	18	2	考试 Exam.
0111004	毛泽东思想和中国特色社会主义理论体系概论 Mao Zedong Thoughts and Theory of the Socialism with Chinese Characteristics	4	6	72	36	4	考试 Exam.
1711005-1711011	形势与政策 1-7 The Current Situation and Policy(1-7)	1-7	2				考查 Quiz
0211012	大学语文（理、艺、体） College Chinese (for Science, Art and P.E. Specialties)	2	2	36		2	考试 Exam.
1211044	计算机基础（理工科） Fundamentals of Computer (for Science Specialties)	1	2	27	18	2	考试 Exam.
1211045	VB 程序设计（理工科） VB Programming(for Science Specialties)	2	3	36	36	2	考试 Exam.
0411046	大学外语（一） College English 1	1	3	36	36		考试 Exam.
0411047	大学外语（二） College English 2	2	3	36	36		考试 Exam.
0411048	大学外语（三） College English 3	3	3	36	36		考试 Exam.
0411049	大学外语（四） College English 4	4	2	36			考试 Exam.
0411050	外语综合应用能力培训 Integrated Skills of Foreign Languages	4	1		36		考试 Exam.
1011039	大学体育（一） Physical Education 1	1	1	36			考试 Exam.
1011040	大学体育（二） Physical Education 2	2	1	36			考试 Exam.
1011041	大学体育（三） Physical Education 3	3	1	36			考试 Exam.
1011042	大学体育（四） Physical Education 4	4	1	36			考试 Exam.

2.通识教育选修课（8 学分）

2.Liberal Studies Elective Courses (8 credits)

通识教育选修课（含当代世界经济与政治）共 8 学分，详见《陕西师范大学通识教育选修课课程方案》。

Undergraduates will obtain 8 credits by taking liberal studies elective courses including the course of Current World Economics and Policy, *see Liberal Studies Elective Courses Scheme of Shaanxi Normal University.*

（二）学科基础模块（22.5 学分）

(Ⅱ) Disciplinary Foundation Courses (22.5 credits)

1.相关学科基础课（16.5 学分）

1.Related Disciplinary Foundation Courses (16.5 credits)

课程编码 Courses Code	课程名称 Courses Name	开课学期 Semester	学分 Cre.	讲授学时 Teaching Hrs.	实验/实践学时 Experiment/ Training Hrs.	周学时 Weekly Hrs.	考试方式 Evaluation
0521005	高等数学（二）—1（理） Advanced Mathematics 1 (for Science Specialties)	1	4	72		5	考试 Exam.
0521006	高等数学（二）—2（理） Advanced Mathematics 2 (for Science Specialties)	2	4	72		4	考试 Exam.
3521001	普通物理及实验 General Physics and Experimental	3	5.5	90	18	5	考试 Exam.
3521002	线性代数与概率 Linear Algebra and Probability	3	3	54		4	考试 Exam.

2.本学科基础课（6 学分）

2. Disciplinary Foundation Courses (6 credits)

课程编码 Courses Code	课程名称 Courses Name	开课学期 Semester	学分 Cre.	讲授学时 Teaching Hrs.	实验/实践学时 Experiment/ Training Hrs.	周学时 Weekly Hrs.	考试方式 Evaluation
3522001	无机化学（上） Inorganic Chemistry (I)	1	3	54		4	考试 Exam.
3522002	无机化学（下） Inorganic Chemistry (II)	2	3	54		4	考试 Exam.

（三）专业课程模块（54 学分）

(Ⅲ) Specialized Courses (54 credits)

1.专业必修课（38.5 学分）

1. Specialized Compulsory Courses of Specialty (38.5 credits)

课程编码 Courses Code	课程名称 Courses Name	开课学期 Semester	学分 Cre.	讲授学时 Teaching Hrs.	实验/实践学时 Experiment/ Training Hrs.	周学时 Weekly Hrs.	考试方式 Evaluation
3541001	物理化学（上） Physical Chemistry I	3	3	54		3	考试 Exam.
3541002	物理化学（下） Physical Chemistry II	4	3	54		3	考试 Exam.
3541003	有机化学（上） Organic Chemistry I	3	3	54		3	考试 Exam.
3541004	有机化学（下） Organic Chemistry II	4	3	54		3	考试 Exam.
3541005	材料科学与工程专业引导 Introduction to Materials Science and Engineering	1	1	18		2	考查 Quiz
3541006	研究方法与学术论文写作 Direction of Research Approach and Academic Dissertation Writing	6	1	18		2	考试 Exam.
3541007	材料科学与工程基础 Fundamentals of Materials Science and Engineering	5	3	54		5	考试 Exam.
3541008	结构化学 Structural Chemistry	5	3	54		3	考试 Exam.
3541009	材料物理性能学 Physical Properties of Materials	6	2.5	48		4	考试 Exam.
3541010	分析化学（含仪器分析） Analytical Chemistry (including Instrumental Analysis)	2	4	72		4	考试 Exam.
3544008	基础无机化学实验（上） Basic Experiments in Chemistry I	1	1.5		48	4	考试 Exam.

3544001	基础无机化学实验（下） Basic Experiments in Chemistry II	2	1		44	4	考试 Exam.
3544002	基础分析化学实验 Experiments in Analytical Chemistry	2	1		36	4	考试 Exam.
3544003	基础有机化学实验（上） Experiments in Organic ChemistryI	3	1.5		52	4	考试 Exam.
3544004	基础有机化学实验（下） Experiments in Organic Chemistry II	4	1.5		56	4	考试 Exam.
3544005	基础物理化学实验（含结构） Experiments in Physical / Structural Chemistry	4	2.5		88	4	考试 Exam.
3544006	微结构与物理性能实验 Experiments in Physical Properties and Micro-structure of Materials	5	1.5		56	8	考试 Exam.
3544007	高分子材料实验 Experiments in Polymer Materials	5	1.5		54	4	考试 Exam.

2.专业限定选修课（8 学分）

2. Defined Selective Course of Specialty (8 credits)

课程编码 Courses Code	课程名称 Courses Name	开课学期 Semester	学分 Cre.	讲授学时 Teaching Hrs.	实验/实践学时 Experiment/ Training Hrs.	周学时 Weekly Hrs.	考试方式 Evaluation
3542001	材料科学前沿讲座（1） Lectures on Latest Development in Materials Science	6	1.5	28		2	考查 Quiz
3542002	材料化学专业英语（2） Materials Chemistry English	6	1.5	28		2	考试 Exam.
3542003	液晶化学（3） Liquid Crystal Chemistry	5	1.5	28		2	考试 Exam.
3542004	文物保护材料（4） Materials in Protection of Cultural Relics	5	1.5	28		2	考试 Exam.
3542005	纳米材料学（5） Nanostructural Materials	7	2	36		2	考试 Exam.

3.专业任意选修课（8 学分）

3. Specialized Non-restrictive Elective Courses (8 credits)

详见学院专业任意选修课。

See Specialized Non-restrictive Elective Courses of School of Materials Science and Engineering.

（四）专业技能模块（必修课）(21.5 学分）

(Ⅳ) Professional Skills Courses (Compulsory Courses, 21 .5 credits)

课程编码 Courses Code	课程名称 Courses Name	开课学期 Semester	学分 Cre.	讲授学时 Teaching Hrs.	实验/实践学时 Experiment/ Training Hrs.	周学时 Weekly Hrs.	考试方式 Evaluation
3541011	功能材料 Functional Materials	6	3.5	64		4	考试 Exam.
3541012	无机材料合成方法 Synthetic Chemistry of Inorganic Materials	5	2	36		2	考试 Exam.
3541013	材料表征技术 Analytical Techniques of Materials	5	3	54		3	考试 Exam.
3541014	高分子化学与物理 Polymer Chemistry and Physics	5	3	54		3	考试 Exam.
3544009	材料制备与表征实验 Experiments in Preparation and Characterization of Materials	6	2		72	4	考试 Exam.

3545001	功能材料综合实验 Comprehensive Experiments in Functional Materials	6	2		72	8	考试 Exam.
3546001	专业课程实践 Specialty Course Practice	7	6		12 周		考查 Quiz

（五）实践模块（11 学分）

(Ⅴ) Practice Work(11 credits)

课程编码 Courses Code	课程名称 Courses Name	开课学期 Semester	学分 Cre.	讲授学时 Teaching Hrs.	实验/实践学时 Experiment/ Training Hrs.	周学时 Weekly Hrs.	考试方式 Evaluation
2650101	军事理论与训练 Military Theory and Military Training	1	1				考查 Quiz
3550017	必读书目阅读 Compulsory Readings		1				考查 Quiz
3550023	专业见习 Professional Visits	1-6	1				考查 Quiz
3550024	专业实习 Professional Practice	7	2				考查 Quiz
3550021	专业实践与社会调查 Professional Practice and Social Survey		1				考查 Quiz
3550022	科研训练 Scientific Research Training	3-6	1				考查 Quiz
1750016	大学生职业生涯规划 Career Development and Planning		1				考查 Quiz
1750013	大学生就业指导 College Students' Employment Guidance	6	1				考查 Quiz
3550025	毕业论文（设计） Graduation Thesis	7-8	2				考查 Quiz

十、材料化学专业任意选修课

X.Specialized Non-restrictive Elective Courses of School of Materials Science and Engineering

课程编码 Courses Code	课程名称 Courses Name	开课学期 Semester	学分 Cre.	讲授学时 Teaching Hrs.	实验/实践学时 Experiment/ Training Hrs.	周学时 Weekly Hrs.	考试方式 Evaluation
3543001	能源材料 Energy Materials	5	2	32		2	考查 Quiz
3543002	功能高分子多孔材料 Functional Polymer Materials with Porous Structure	6	2	32		2	考查 Quiz
3543003	微纳米材料合成方法 Synthetic Method for the Micro/Nanometer Materials	6	2	32		2	考查 Quiz
3543004	仿生材料学 Biomimetic Materials	6	2	32		2	考查 Quiz
3543005	涂料化学 Coating Chemistry	7	2	32		2	考查 Quiz
3543006	现代表征技术与科技考古 Modern Methods of Analysis and Archeometry	7	2	32		2	考查 Quiz
学生选修说明 Notes	必须选修 8 学分。 Students should obtain 8 credits in Non-restrictive Selective Courses.						

十一、课程简介

XI. Brief Introduction of Main Courses

（一）学科基础模块(Disciplinary Foundation Courses)

1.课程名称：无机化学(上)/无机化学（下）

（1）课程编码：3522001/3522002

（2）课程简介：无机化学是材料化学专业的第一门主干必修基础课，在专业课的学习中起着承前启后的作用。无机化学课程内容包含基础化学原理和元素化学两部分，它们互相渗透，紧密联系，组成了无机化学课程的整体。在化学原理部分，分别介绍原子结构与元素周期系、分子结构、配合物、化学平衡及其指导下的四大平衡、化学热力学基础、化学动力学基础等。在元素化学部分，重点介绍元素周期表中各主族元素、副族元素（包括镧系元素和锕系元素）尤其是代表元素的单质及其化合物的结构、性质、制备和用途，并运用结构化学和热力学、动力学原理进行必要解释。

1. Course Name: Inorganic Chemistry

(1) Course Code: 3522001/3522002

(2) Brief Introduction of the Course:Inorganic Chemistry is a compulsory course for undergraduates majoring in Material Chemistry. The contents of the course are divided in two sections. The section of chemistry principles introduces the fundamentals of atomic structure, the periodic system of elements, molecular structure, metal complexes, chemical equilibrium, chemical thermodynamics, and chemical kinetics. The other section emphasizes the structure, properties, preparation and applications of main group elements and compounds, and transition metal elements and compounds.

（二）专业课程模块（Specialized Courses）

1.课程名称：物理化学(上)/物理化学（下）

（1）课程编码：3541001/3541002

（2）课程简介：物理化学是本科生的的一门主干必修基础课程。主要内容上册包括热力学第一定律、热力学第二定律、溶液、相平衡、化学平衡、统计热力学基础；下册包括电解质溶液、可逆电池电动势及其应用、电解和极化作用、化学动力学基础(Ⅰ)和(Ⅱ)、界面物理化学、胶体与高分子溶液等。

1. Course Name: Physical Chemistry

(1) Course Code:3541001/3541002

(2) Brief Introduction of the Course:Physical Chemistry is a compulsory course for students in School of Material Science and Engineering. The course is divided into two parts. Part One explains the fundamentals of the first law and second law of thermodynamics, phase diagrams, chemical equilibrium, and statistical thermodynamics. Part Two emphasizes the fundamentals of equilibrium electrochemistry, chemical kinetics, processes at solid surfaces, colloid and polymer solutions, etc..

2.课程名称：有机化学（上）/有机化学（下）

（1）课程编码：3541003/3541004

（2）课程简介：有机化学是材料化学专业本科生的主干必修基础课程。内容主要包括共价键的性质、有机化合物的立体异构、空间效应、电子效应、共振论等有机化学的基础理论；各类有机化合物的结构、物理性质、反应性质、反应机理及其制备方法和用途；有机化合物结构测定的现代物理方法等。

2. Course Name: Organic Chemistry

(1) Course Code:3541003/3541004

(2) Brief Introduction of the Course:Organic Chemistry course is a compulsory foundation course for undergraduates majoring in Material Chemistry. The course is divided into three sections. The first section introduces and explains the fundamentals of conjugated system, stereochemistry, spatial effects, electronic

effects, and resonance. The second section shows the structure and properties of organic molecules. The last section introduces the modern physical methods to determine the structure of organic compounds.

3.课程名称：**材料科学与工程专业引导**

（1）课程编码：3541005

（2）课程简介:《材料科学与工程专业引导》是材料化学本科专业的一门必修专业课。主要内容包括：材料的定义与分类，材料在人类社会发展进程中的地位和作用，材料科学与工程的形成和发展；材料的“四要素”—组成与结构，性质，合成与制备工程以及使用性能，材料研究手段和方法；结构材料其中包括钢铁材料，有色金属材料，陶瓷材料，玻璃材料、水泥材料、高分子材料和复合材料；功能材料其中包括超导材料，纳米材料，能源材料，热电材料，功能陶瓷材料，功能高分子材料和生物材料。

3. Course Name: Introduction to Materials Science and Engineering

(1) Course Code:3541005

(2) Brief Introduction of the Course:Introduction to Materials Science and Engineering is a compulsory course for chemistry material majors in School of Material Science and Engineering. It includes the definition and classification of materials, the role of materials in the development of human society, the formation and development of materials science and engineering, "four elements" of material (composition and structure, nature, synthesis and preparation engineering, and performance), research means and method of materials, structure material which including steel material, material of nonferrous metals, ceramic material, glass material, cement material, polymer material and composite material, function material which including superconducting material, Nano material, energy material, thermoelectric material, function ceramic material, function polymer material and biological material.

4.课程名称：研究方法与学术论文写作

（1）课程编码：3541006

（2）课程简介：研究方法与论文写作指导是本科生的一门必修课。通过该课程学习，使学生较全面地了解科学研究的一般方法以及提高运用这些方法能力的途径。掌握多种形式学术论文的一般写作规范；提高学生学术论文写作能力；为将来撰写不同形式学术论文打下一定的基础，以适应研究型人才培养需求。为达到此目的，该课程将主要涉及两个方面的内容：一是研究方法：主要包括科学方法论、近代科学研究方法特点、复杂性科学研究方法论纲和典型科学研究方法解析等内容。二是学术论文写作：主要包括学术论文的一般形式和特点、学术论文各部分的写作要求与写作方法和开题报告与答辩报告的一般要求等内容。

4. Course Name: Direction of Research Approach and Academic Dissertation Writing

(1) Course Code:3541006

(2) Brief Introduction of the Course:Direction of Research Approach and Academic Dissertation Writing is a compulsory course for chemistry material majors. One aim of this course is to let the students know the methods of research as well as improve their ability applying those methods. The other aim is to let the student master the writing standard of scientific paper, improving the writing ability of students. To meet the needs above, the contents of this course are divided into two sections. One section concerns with research method, including scientific methodology, the outline of complex scientific methodology, as well as the analysis of representative scientific methodology. The other section is related to composition of scientific paper, containing the form and characteristic of scientific paper, the writing requirement and method of scientific paper, as well as the standard of opening and replying report.

5.课程名称：材料科学与工程基础

（1）课程编码：3541007

（2）课程简介:《材料科学与工程基础》系材料化学专业的核心课程，属于专业基础课（3 学分）。

本课程从材料科学与工程的基本原理出发，综合介绍各种材料的组成、结构、制备工艺、性能及应用的共性规律及金属材料、无机非金属材料和有机高分子材料的个性特点和多种组分复合体系的基本特征。内容包括物质结构基础、材料组成与结构、材料的性能材料、制备与加工成型。通过本课程的学习使学生建立材料制备—加工—结构—性能关系的整体概念。

5. Course Name: Fundamentals of Materials Science and Engineering

(1) Course Code:3541007

(2) Brief Introduction of the Course:Fundamentals of Materials Science and Engineering is a compulsory course for chemistry material majors in School of Material Science and Engineering. It introduces and explains the foundation of material structure, especially the structure, properties and preparation of functional materials. The purpose of this course is to make the students know the relationship of preparation, structure and properties.

6.课程名称：结构化学

（1）课程编码：3541008

（2）课程简介：结构化学是材料化学等相关专业的一门主干基础课程，是物理化学的重要分支。它是在原子、分子的水平上研究原子、分子、晶体结构的运动规律以及物质微观结构和其性能间的关系的科学。主要内容包括量子力学基础、原子结构理论、分子轨道理论、杂化轨道理论、双原子分子结构与光谱、紫外光电子能谱与成键性质、HMO 法及共轭分子的结构、分子对称性与点群、前线轨道理论与对称性守恒原理、配位场理论、几何结晶学、X—射线结晶学、结晶化学等。学习这门课程的目的在于使学生在前修课程的基础上进一步掌握微观物质运动的基本规律——量子力学基础，获得原子、分子和晶体结构的基本理论和基础知识，深入理解结构和性能之间的关系，深化对前修课程的理解，培养学生能运用结构化学的基本原理和方法去分析和解决实际问题的能力。

6. Course Name: Structural Chemistry

(1) Course Code: 3541008

(2) Brief Introduction of the Course:Structural Chemistry is a compulsory course for material chemistry majors in School of Material Science and Engineering. The contents of this course contain the principle of quantum mechanics, atomic structure theory, molecular orbital theory, hybrid orbital theory, structure and spectra of diatomic molecules, ultraviolet photoelectron spectra and bonding properties, HMO method and structure of conjugated molecular, molecular symmetry and group of points, frontier molecular orbital theory and conservation principle of symmetry, crystal-field theory of complexes, coordination field theory, geometric crystallography, x-ray geometric crystallography, crystal chemistry, etc..

7.课程名称：材料物理性能学

（1）课程编码：3541009

（2）课程简介：材料物理性能是材料化学专业的一门专业必修课程。其主要内容包括：固体中的电子能量结构和状态，材料的电、介电、光、热、磁、弹性和内耗（阻尼）性能及其发展，阐述了各种性能的重要原理及微观机制、各种材料成分、组织结构与性能关系及主要制约规律。其特色是把金属材料、陶瓷材料与高聚物材料的物理性能做了扼要的对比，以利于学生掌握材料物理性能的一般规律和特殊性。

7. Course Name: Physical Properties of Materials

(1) Course Code:3541009

(2) Brief Introduction of the Course:Physical Properties of Materials is a compulsory course for chemistry material majors in School of Material Science and Engineering. It introduces and explains the fundamentals and development of materials related to physical properties of materials (electron energy structure and status, electrical, dielectric, light, heat, magnetic, elastic and internal friction (damping) properties). It provides introduction to the relationship of composition, structure and property of materials. It compares the physical property of metallic materials, ceramic material and polymer material, which benefits

the students to grasp the general rule and particularity of physical properties of materials.

8.课程名称：分析化学（含仪器分析）

（1）课程编码：3541010

（2）课程简介：分析化学是以滴定分析法、重量分析法和分析实验数据处理为重点，并简要介绍分析化学中的分离方法等为基本内容的化学基础课程。是我院材料化学专业本科生的专业必修课程。其具体教学内容包括酸碱滴定法、络合滴定法、氧化还原滴定法、沉淀滴定法和重量分析方法以及复杂物质的分离分析方法简介。教学的目的是通过这些方法的学习和相关滴定分析等实验基本技能的培训，使学生不但掌握滴定分析、重量分析方法等的方法的基本原理，而且还要使学生能在将来根据科学研究和其它分析任务的要求，应用这些已学的方法设计出合理的分析方案或分析方法来解决实际问题。除此之外，在本课程的学习内容中还包括了误差和实验数据一章，其核心目的是培养学生如何科学、准确的记录、处理和报道实验结果和数据。

8. Course Name: Analytical Chemistry（including Instrumental Analysis）

(1) Course Code:3541010

(2) Brief Introduction of the Course: Analytical Chemistry is a compulsory course for the students in School of Material Science and Engineering. The course covers the basics of classical analysis. It emphasizes the analytical method of acid-base titration, complexion titration, oxidation-reduction titration, precipitation titration and gravimetric analysis as well as the method of complex material separation. Besides, it also introduces error and experimental data processing, showing how to accurately record, process and report the test results and data.

9.课程名称：基础无机化学实验（上）/基础无机化学实验（下）

（1）课程编码：3544008/3544001

（2）课程简介：基础无机化学实验，是材料化学专业第一门必修的、独立的基础实验课，它对奠定学生的良好实验基础特别重要。课程的安排服从“一体化、多层次、开放式”的教学体系和模式。教学内容着力于培养学生具有宽广的无机化学实验基础知识和熟练的基本技能。性质实验是加强学生对无机元素知识学习的重要一环，合成实验和综合实验是训练和巩固基本操作的重要环节，也是培养学生正确选择无机化合物的合成方法、分离提纯及分析鉴定方法的主要途径，是无机化学实验课的主要内容。总之，学生通过实验活动，学习和掌握无机化学专业的基本实验技术，验证元素单质及其化合物的重要性质，熟悉重要无机化合物的制备及表征方法。培养学生严谨的科学态度和准确观察化学反应现象、处理实验数据的能力，达到训练学生基本理论知识的综合应用能力。

9. Course Name: Basic Experiments in Chemistry

(1) Course Code: 3544008/3544001

(2) Brief Introduction of the Course:Basic Experiments in Chemistry is an experimental course in inorganic chemistry. It contains selected experiments, which concerns concepts, experimental safety, the importance of observation, the synthesis and characterization of chemicals, equilibrium studies, etc.. The experimental course intents：(a) to train the experimental technique of student; (b) to develop the students' ability of applying chemical knowledge; and (c) to stimulate the interests of students to chemical study.

10.课程名称：基础分析化学实验

（1）课程编码：3544002

（2）课程简介： 基础分析化学实验是我院本科生的专业基础课程之一。课程的教学目标是培养学生从事分析化学实验工作的基础知识、基本技能和基本操作等方面的能力。具体教学内容包括各种滴定分析方法的基本操作，分析天平的原理、操作和各种称量方法学习以及容量瓶、移液管等的基本操作训练和学习。使学生不但掌握滴定分析、重量分析等实验方法的基本原理和操作，而且还要培养

学生分析实验现象并解决实验问题的能力。

10. Course Name: Experiments in Analytical Chemistry

(1) Course Code:3544002

(2) Brief Introduction of the Course:Experiments in Analytical Chemistry is an experimental course in analytical chemistry. The contents of this course contain selected experiments, which illustrates and tests the established theoretical principle of titration analysis and gravimetric analysis. The experimental course intents：(a) to train the student's experimental technique in analytical chemistry, (b) to develop the student's ability of applying chemical knowledge, and (c) to stimulate the interests of students to chemical research.

11.课程名称：基础有机化学实验(上)/基础有机化学实验（下）

（1）课程编码：3544003/3544004

（2）课程简介：基础有机化学实验，是一门独立于有机化学课程之外的必修课。本课程突出对学生有机化学综合实验能力的培养。课程的安排着力于培养具有宽广的有机化学知识基础和熟练的基本技能、能够适应未来发展需要的专业人才。本课程内容主要包含有机化学实验的基本知识、基本操作及其原理与要点；典型化合物的合成和制备技术；较复杂有机化合物的多步骤合成实验；有机化合物的定性鉴定和波谱学分析。通过这些实验使学生掌握有机化学实验的基本操作技术和技能，学会正确选择有机化合物的合成方法，分离提纯及分析鉴定的方法等。

11. Course Name: Experiment in Organic Chemistry

(1) Course Code:3544003/3544004

(2) Brief Introduction of the Course:Experiments in Organic Chemistry is an experimental course in organic chemistry. It involves selected experiments, which demonstrated established principle of organic chemistry. The contents of this course concerns synthesis and characterization of organic chemicals. The purposes of this course are：(a) to illustrate and test established theoretical principles of organic chemistry, (b) to train the experimental technique of student, and (c) to develop the interests of students to chemical research.

12.课程名称：基础物理化学实验（含结构）

（1）课程编码：3544005

（2）课程简介：本课程突出对学生物理化学综合实验能力的培养。内容主要包括物理化学实验的基本知识、基本操作及其基本原理。通过强化实验技能训练，使学生系统掌握物理化学的基本实验技能、研究方法和基本技术。

12. Course Name: Experiments in Physical /Structural Chemistry

(1) Course Code:3544005

(2) Brief Introduction of the Course:Experiments in Physical Chemistry is an experimental course in physical chemistry. Physical chemistry deals with the physical principles underlying the properties of chemical substances. Like other branches of physical science, it contains a body of theory which has stood the test of experiment and which is continually growing as a result of new experiments. The experimental course in physical chemistry involves selected experiments, which demonstrated established principle of physical chemistry. The purposes of this course are: (a) to illustrate and test established theoretical principles of physical chemistry, (b) to train the experimental technique of student, and (c) to develop a research orientation by providing basic experience with physical measurements that yield quantitative results of important chemical result.

13.课程名称：微结构与物理性能实验

（1）课程编码：3544006

（2）课程简介：微结构与物理性能实验是材料化学专业的一门专业必修课程。主要利用扫描电镜，透射电镜，X 射线衍射，拉曼光谱和物理吸附仪和对纳米材料，介孔材料和陶瓷材料的组成、形

貌，尺寸以及晶体结构进行表征分析，确定其微结构。研纳米材料，介孔材料和陶瓷材料的光吸收，光致发光，拉曼，化学传感，表面积，孔径分布，导电能力，磁学，铁电与压电性能等。使学生掌握材料结构表征以及物理性能测试方法与原理，了解相关仪器的使用方法。

13. Course Name: Experiments in Physical Properties and Micro-structure of Materials

(1) Course Code:3544006

(2) Brief Introduction of the Course:Experiments in Physical Properties and Micro-structure of Materials is a compulsory course for chemistry material majors. The aim of this course is to let the students know the principle and method of characterizing the structure and physical properties of materials, as well as the operation method of the related instruments. The composition, morphology, size and the structure of crystal are characterized using techniques of scanning electron microscope, transmission electron microscope, Raman spectrum and nitrogen physisorption, etc.. The properties of materials (i.e., Nano-materials, mesoporous materials and ceramic materials) would be analyzed,for example,light absorption, photoluminescence,chemical sensor,surface area, pore size distribution,conductivity, magnetics, ferroelectric and piezoelectric properties.

14.课程名称：高分子材料实验

（1）课程编码：3544007

（2）课程简介：高分子材料实验是材料化学专业的一门专业基础实验课程。它对奠定学生从事高分子材料实验的良好基础特别重要。因此，本大纲所规定的 50 学时，除考试占 4 学时外，其余全部用于实验。本实验设置的目的是：通过研究高分子材料的重要物理性质与重要高分子聚合物的制备；验证并加深理解和巩固掌握所学基本理论和基础知识；比较牢固地掌握高分子材料科学研究的基本知识和操作技能训练；培养学生初步掌握高分子化学实验的技能及严谨的科学态度；培养学生准确观察化学反应现象，处理实验数据的能力。

14. Course Name: Experiments in Polymer Materials

(1) Course Code:3544007

(2) Brief Introduction of the Course:Experiments in Polymer Materials is an experimental course for material chemistry majors. The period of this course is 50 class hours, including 4 class hours for examination. It contains selected experiments, which concern the synthesis and physical properties of important polymers. The experimental course intents: (a) to train the student’s experimental technique about synthesis and characterization of polymer materials, and (b) to develop the student’s ability of applying chemical knowledge.

15.课程名称：材料科学前沿讲座

（1）课程编码：3542001

（2）课程简介：材料科学前沿讲座是材料化学本科专业的一门专业限定选修课。本课程将邀请本学院不同研究方向在学术上颇有造诣的副高以上职称教师，结合本人在研究方向上取得的研究成果，系统的向学生介绍材料科学与工程专业各研究方向的最新研究进展，发展方向，技术难点和关键等，本课程主要面向学院高年级本科生，在学习一定的专业基础课知识的基础上，传授材料学前沿理论，拓宽专业知识面，培养科研思维能力。

15. Course Name: Lectures on Latest Development in Materials Science

(1) Course Code:3542001

(2) Brief Introduction of the Course:Special Lecture on the Progress of Material Science is an elective course of School of Materials Science and Engineering. The professors or assistant professors who did a well work in their directions will be invited to give some lecture to introduce the latest research progress and the direction of development of materials science and engineering. The course mainly caters for senior undergraduate students, which will benefit students to broaden the professional knowledge and improve the scientific research ability.

16．课程名称：材料化学专业英语

（1）课程编码：3542002

（2）课程简介：材料化学专业英语是专业限定选修课，内容主要包括无机、有机、分析、物化及材料化学与物理等专业词汇，元素的英文名及符号，常用玻璃器皿，常见聚合物材料的缩写，常用化学分子式、方程式及数学式的读法，化学常用词头及词尾的含义，化学上常见的缩略语，化学上常用的词头及词尾的含义，各种专业参考书、文献中的表述。

16. Course Name: Materials Chemistry English

(1) Course Code:3542002

(2) Brief Introduction of the Course:Materials Chemistry English is an elective course. It includes vocabularies and abbreviations of elements, compounds, polymers, and glasswares in inorganic, organic, analytic, physical chemistry, and fundamental words in physics, along with their pronunciation. The course also explains the prefixes and suffixes of chemical compounds and common expressions in references and literatures.

17.课程名称：液晶化学

（1）课程编码：3542003

（2）课程简介：液晶化学是材料化学专业一门专业限定选修课。液晶材料是功能化的软材料之一，是21世纪信息时代的一种重要显示用材料。而液晶化学课程主要讲述液晶材料的基本概念；液晶作为显示用材料要满足的基本要求；液晶化合物结构与性能的影响关系；液晶化合物的合成设计与典型反应；液晶化合物的纯化分离及表征方法；液晶混合配方的设计原则；液晶材料的发展趋势等内容。该课程的主要任务是使学生理解液晶形成的内在本质，掌握液晶材料的合成、纯化和分析表征技术，为今后从事新材料开发与研制工作打下坚实基础。

17. Course Name: Liquid Crystal Chemistry

(1) Course Code:3542003

(2) Brief Introduction of the Course:Liquid Crystal Chemistry is an elective course for material chemistry majors. As one kind of soft materials, liquid crystal materials have played an important role in our daily lives in the information era. The course places an emphasis on the definition and classification of liquid crystal materials, the basic requirements of liquid crystal materials for LCD application, the relationships between structure and properties of liquid crystal, the design and classical reactions for liquid crystals, the characterization and purification methods for liquid crystals, the rules for liquid crystal mixture, the progress in liquid crystal materials. It will help students to understand the driving forces for the formation of liquid crystal phase, to grasp the synthesis, purification and characterization of liquid crystals. The students are supposed to lay a solid foundation for future development of new materials from the course.

18.课程名称：文物保护材料

（1）课程编码：3542004

（2）课程简介:《文物保护材料》是延长与恢复文物与古遗迹原貌寿命的科学，是化学、材料学、环境科学、生物学与工艺技术、工程技术以及文化艺术相互渗透的有机结合体，主要包括三个方面：第一，文物与古遗迹材料的化学组成研究；第二，文物与古遗迹病害机理在相关环境中的衰变规律以及适宜保存环境研究；第三，文物与古遗迹材料的保护修复机理、保护修复材料和保护修复工艺研究。文物与古遗迹材料非常丰富，种类繁多，主要有：遗址土壤、青铜器、铁器、陶器、瓷器、丝绸、漆木器、竹简、壁画、建筑木构件、石刻、砖瓦、纸张、颜料、染料、胶料、照片、底片、电影胶片、唱片、录音带、录像带等。

18. Course Name: Materials in Protection of Cultural Relics

(1) Course Code:3542004

(2) Brief Introduction of the Course:Cultural relics conservation is to extend the service life and restore the original appearance of the objects and ancient site. It combines with chemistry, material science, environmental science, biology, technology, engineering, culture and arts. This subject mainly contains three aspects: firstly, chemical compound study of relics' and sites' material; secondly, research on disease mechanism, law of radioactive decay in certain environment, and suitable preservation unit; thirdly, study of the conservation mechanism, material and technology. There are abundant relics and sites material dividing into different varieties, such as earth site, bronze ware, ironware, earthenware, chinaware, silk, lacquer wood, bamboo slips, mural, wood accessory of building, carved stone, tiles and bricks, paper, pigment, dyestuff, sizing material, photograph, negative film, cine film, record, magnetic and video tape etc..

19.课程名称：纳米材料学

（1）课程编码：3542005

（2）课程简介：纳米材料是材料化学专业的一门专业限定选修课程。纳米技术和纳米材料科学是20世纪80年代末发展起来的新兴学科。由于纳米材料具有许多传统材料无法媲美的奇异特性和非凡的特殊功能，因此在各行各业中将有空前的应用前景，它将成为21世纪新技术革命的主导中心。本课程系统的介绍纳米材料和纳米结构。其中包括：纳米科技的基本概念和内涵，纳米材料的研究对象和发展历史，团簇、纳米颗粒、碳纳米管、纳米线、纳米带、纳米电缆、纳米片、纳米方块等纳米结构单元的结构与制备，纳米微粒的基本理论，纳米微粒的结构与物理化学特性。

19. Course Name: Nanostructured Materials

(1) Course Code:3542005

(2) Brief Introduction of the Course:Nanostructured Materials is an elective course for chemistry material majors in School of Materials Science and Engineering. Nano-technologies or nano-materials science is a discipline developed in the 1980s. Because nano-materials have many remarkable special functions comparable to the traditional materials, it will have unprecedented prospect and become leading centers of the new technological revolution in 21st century. This course covers a systematic introduction of nano-materials and nano-structures. It is divided into three parts. The first part gives an introduction of the concept and development history of nanotechnology and nano-materials. The second part emphasizes the structure, properties and preparation of nano-structural unit such as clusters, nanoparticles, carbon nanotubes,nanowires, Nano patch, Nano square, Nano cables, etc.. The last part shows the fundamentals of nano-materials.

（三）专业技能模块（Professional Skills Courses）

1.课程名称：功能材料

（1）课程编码：3541011

（2）课程简介：功能材料是材料化学专业一门重要的专业必修课。功能材料是具有电、磁、光、声、热、力、化学以及生物学功能的新型材料，是信息技术、生物技术、能源技术、环境保护等高技术领域和国防建设的重要基础材料。本课程主要介绍与学科发展前沿相关的功能材料类型及其组成、结构、性能、制备和应用等内容。着重介绍功能材料物理化学性能与其组成和微观结构之间的关联性，加深学生对材料功能特性产生的内在本质理解。同时，该课程还将介绍材料功能特性基本实验测试方法与分析技术，以提高学生综合分析、解决问题的能力，为今后从事新材料研究与技术开发奠定基础。

1. Course Name: Functional Materials

(1) Course Code:3541011

(2) Brief Introduction of the Course:Functional Materials is a compulsory course for material chemistry majors in School of Materials Science and Engineering. Functional materials are a large class of new materials with special features, such as electric, magnetic, optical, acoustic, thermal, mechanical, chemical, and biological features. They are the important basic materials in the area of information technology, biotechnology, energy technology, national defense construction, etc.. This course introduces and explains the composition, structure, property, preparation and application of functional materials. Its main

message is the research frontiers of functional materials. The purposes this course are to (a) teach the students of the method to characterize functional materials, and (b) train the student's experimental technique.

2.课程名称：无机材料合成方法

（1）课程编码：3541012

（2）课程简介：无机材料合成化学是材料化学专业一门重要的专业必修课，在材料化学专业的学习中起着承前启后的作用，又是研究和开发新型无机材料的基础。无机材料合成化学是通过一定的途径、手段，从气态、液态或固态的各种不同原材料中得到化学上及性能上不同于原材料的无机新材料，重点介绍气相法、液相法、固相法三大类合成技术以及无机材料合成技术的应用前沿领域。

2. Course Name: Synthetic Chemistry of Inorganic Materials

(1) Course Code:3541012

(2) Brief Introduction of the Course:Synthetic methods of Inorganic Materials are a compulsory course for chemistry material majors in School of Material Science and Engineering. It introduces the three main methods to synthesize inorganic materials, namely, gas–phase method, liquid–phase method and solid–phase method. Moreover, it provides introduction to the application frontiers of synthetic methods related to inorganic materials.

3.课程名称：材料表征技术

（1）课程编码：3541013

（2）课程简介：材料表征技术是材料化学专业的一门专业必修课程。主要介绍材料组成、结构和形貌分析表征相关仪器的基本原理与应用。其中包括材料分析方法基础、X 射线衍射分析方法、电子显微分析方法、光谱、电子能谱分析方法以及热分析方法等。介绍这些表征方法在金属材料，无机非金属材料，有机高分子材料和复合材料等方面的应用。

3. Course Name: Analytical Techniques of Materials

(1) Course Code:3541013

(2) Brief Introduction of the Course:Analytical Techniques of Materials is a compulsory course for chemistry material majors in School of Material Science and Engineering. Its main message is that the fundamentals and application of instruments characterizing the composition, structure and morphology of materials. It provides introduction to the analytical method of materials, such as X-ray diffraction, Electron microscope, spectrum, energy dispersive x-ray spectroscopy, thermogravimetric analysis. Moreover, it introduces the application of analytical method in metal materials, inorganic non-metal materials, organic polymer materials, and composite materials.

4.课程名称：高分子化学与物理

（1）课程编码：3541014

（2）课程简介：高分子化学与物理是我院本科生的必修课程。主要内容包括高分子化合物的分类和命名、高分子化学的基本概念与基本理论、自由基聚合与共聚合、离子聚合、配位聚合、聚合方法、逐步聚合反应、聚合物的化学反应、高分子化学的新进展与功能高分子，聚合物的结构和性能的关系。通过研究聚合反应和高分子化学反应的原理及实施方法，了解聚合物的结构和性能的关系，使学生能够选择廉价原料，寻找优质催化剂，确定合理的合成路线，制定最佳工艺条件合成或改性制备具有一定性能的聚合物。本课程使学生较熟练地掌握高分子的基本概念，熟悉合成高分子化合物的基本原理及控制聚合物反应速率和分子量的方法，了解高分子化学反应的特征、聚合方法的选择及聚合物的结构和性能的关系。为学生进一步学习高分子相关内容奠定必要的基础。

4. Course Name: Polymer Chemistry and Physics

(1) Course Code:3541014

(2) Brief Introduction of the Course:Polymer Chemistry and Physics is a compulsory course for students in School of Material Science and Engineering. The content of the course is divided into polymer chemistry and polymer physics. The section of polymer chemistry introduces the foundation of polymerization reaction and polymer reaction, and the method to prepare polymer. The section of polymer physics shows the relationship between the structure of polymer and its properties (mechanical, electrical, thermal, as well as solution and aging properties).

5.课程名称：材料制备与表征实验

（1）课程编码：3544009

（2）课程简介：材料制备与表征实验是材料化学专业的一门专业必修课程。主要通过高温固相反应，水热法和化学气相沉积法制备发光材料，陶瓷材料和纳米材料。通过扫描电镜，透射电镜，X射线衍射对所制备的材料进行结构表征，确定其微观结构和晶体结构，采用光刻技术制备出图案化结构 Au 纳米颗粒阵列。使学生掌握材料制备、微加工和结构表征的方法与原理，了解材料表征仪器的结构和使用方法。

5. Course Name: Experiments in Preparation and Characterization of Materials

(1) Course Code:3544009

(2) Brief Introduction of the Course:Experiments in Preparation and Characterization of Materials is a compulsory course for chemistry material majors. The aim of this course is to let the students master the method and principle of preparing and characterizing materials, and know the structure and operation method of instruments characterizing materials. The contents of this course is as follows: the materials (Luminescent materials, ceramics and nanomaterials) are prepared by methods such as high temperature solid-phase reaction, hydrothermal method and chemical vapor deposition; the materials are characterized by using techniques of scanning electron microscope, transmission electron microscope, and X-ray diffraction; pattern structure of Au Nano-particle arrays are prepared by the method of photolithography.

6.课程名称：功能材料综合实验

（1）课程编码：3545001

（2）课程简介：功能材料综合实验是材料科学与工程学院本科生的必修课。所开设实验按照材料制备、结构表征、性能测试等三个主要内容整合单元实验，依据材料功能筛选具有特色的教师科研成果作为整个课程的教学内容。旨在以单元实验所包含相互联系的知识与技能使实验具有综合性；以教师亲历性科研成果指导学生更具深刻性、说服力和明确的目标性、实验内容以科研成果为基础使实验本身具有更明显的研究性；以教师科研成果使学生更多接触学科前沿、更多技术手段、更多从事具有研究属性的科研实践。以科研成果的多学科交叉性和技术的多样性为学生的创新能力的发挥奠定坚实基础。

6. Course Name: Comprehensive Experiments in Functional Materials

(1) Course Code:3545001

(2)Brief Introduction of the Course:Comprehensive Experiments in Functional Materials is a compulsory course for chemistry material majors. The contents of this course come from the characteristic achievements of teachers in scientific research, which is filtered in accordance with the function of material. Each experiment includes three units, i.e., preparation, structure characterization and performance testing. The course has the following characteristics: the course is comprehensive since each experiment includes the interconnected knowledge and skills; the course is deep, compelling, researching-based and has clear objectives because the contents of the course comes from the personal achievements of teachers; the course makes students more exposure to frontier and technology, as well as more engaged in scientific research. Besides, the course has property of interdisciplinary and technical diversity, which lays a solid foundation to the creative ability of students.

（四） 实践模块（Practice Work）

1.课程名称：专业见习

（1）课程编码：3550023

（2）课程简介：专业见习是在本科 1-6 学期期间在教师指导下从事一定科学研究实践活动。这些活动包括参观科研实验室、参加来自各部门小课题研究活动、参加学术报告等。旨在扩大知识视野和提升专业学习与实际应用相结合的能力。

1. Course Name: Professional Visits

(1) Course Code: 3550023

(2) Brief Introduction of the Course:Professional Vistits is a practice course guided by teachers during 1-6 Semesters. The practice course includes visiting laboratories in the school, taking part in scientific investigation students themselves selected, listening lectures etc.. The aim of this course is to enlarge student's knowledge view and enhance consciousness in application of knowledge into practice.

2.课程名称：专业实习

（1）课程编码：3550024

（2）课程简介：专业实习是根据本专业特点在企业、研究机构进行参观与实践的教学活动。本课程将根据材料化学专业特点有选择地在功能材料生产企业和研究机构进行为期 3-4 个星期的参观与实践，旨在学生了解企业生产与管理机制、产品开发与市场对接、规模化生产实际、专业知识与生产实践关系等。

2. Course Name: Professional Practice

(1) Course Code: 3550024

(2) Brief Introduction of the Course:Professional Practice is a practice course in enterprises and institutes which engage in functional material production and investigation. Students should undertake 3-4 weeks of this professional practice. The aim of this course is to make students understand production process and management, exploitation of products, large-scale production, and relation between knowledge and practice in enterprises.

3.课程名称：专业实践与与社会调查

（1）课程编码:3550021

（2）课程简介：专业实践是学生学习实践的一个很重要环节，通过专业实践，使学生受到一次系统而深刻的专业思想教育，每位学生在做好专业实践的同时，结合专业实践的实际，有目的地进行一些专题调查，写出有一定水平的调研报告，增强其从事本职工作的责任心，提高学生综合运用所学专业知识、理论知识及基本技能的水平，培养其从事相关工作的能力。

3. Course Name:Professional Practice and Social Survey

(1) Course Code: 3550021

(2) Brief Introduction of the Course:Professional Practice and Social Survey (PPSS) is the most important integral part of learning practices, and students can get a systematic and profound specialized ideological education. Each student makes a destination for some special investigation combining with the actual professional practice, and writes a certain level of research report, which can enhance their work sense of responsibility and improve the students to use their professional knowledge, basic skill level and cultivate working ability.

4.课程名称：科研训练

（1）课程编码：3550022

（2）课程简介：科研方法训练是材料科学与工程学院在本科生培养计划中设立的必修实践环节，体现在学生从入学到毕业的各个阶段和各种环节中，其中本门课程重点包括以下几个方面：（1）通过

专业综合性、设计性、创新性实验有目的地培养学生自己设计实验和动手能力。（2）通过野外实习、专业实习和生产实践培养学生理论联系实践和解决实际问题的能力；（3）通过参加每周的学术报告和讨论会等学术活动培养学生科学素养；（4）通过主持或参与国家级、校级和院系级的各种科研项目开展科研实践。通过四年的学习和科研训练，能够在老师的指导下设计课题，完成实验，并写出具有一定质量的学术论文；学生在毕业时将具有一定创新意识和创新能力、有一定参与实验和实践的能力以及分析问题和解决问题的能力，为今后独立开展科学研究打下基础。

4. Course Name：Scientific Research Training

（1）Course Code:3550022

（2）Brief Introduction of the Course:Research Methods Training is established in the School of Material Sciences and Engineering in the undergraduate program of compulsory practice, reflected in all stages of students from admission to graduation and a variety of links. This course covers the following aspects: (a) to train students' abilities by designing integrated and innovative experiments; (b) to solve practical problems by fieldwork, professional practice and practice of cultivating student link theory with practice and ability; (c) to develop students' scientific literacy by participating in academic symposiums and weekly seminars and other academic activities, and (d) hosting or participating national, school or department-level scientific research and development projects. Through four years of study and research training, subject to design under the guidance of the teacher, finished the experiment, write with a certain quality of academic papers and students at graduation will have a sense of innovation and innovation ability, must participate in the experiment and practice of ability and the ability to analyze and solve problems, lay the foundation for future scientific research independently.

5.课程名称：毕业论文（设计）

（1）课程编码：3550025

（2）课程简介：本科毕业论文是获得学士学位的必要条件，要求学生在老师的指导下发现或提出科学问题，进行文献资料检索，阅读文献，写出开题报告，设计针对所研究问题的实验方案，并在指定的时间内完成实验、数据采集和统计分析工作，在此基础上写出学位论文，最后通过院系组织的答辩委员会的论文答辩。通过毕业论文培养学生应用所学的专业知识和技能解决实际问题、综合应用知识和各种工具的能力以及文字及学术表达、团队协作、学术表达以及创新能力。

5. Course Name：Graduation Thesis

（1）Course Code:3550025

（2）Brief Introduction of the Course:Graduation thesis writing is the important practical process of cultivating students' comprehensive quality and practical ability. This will greatly help to cultivate the students' ability to solve practical problems, the comprehensive ability of applying knowledge and various tools, writing ability, communication ability, team cooperation ability and spirit of innovation. For about half a year, the students need to carry out research problem choosing, opening report writing, researching, thesis writing and thesis defense.

（五）学院专业任意选修课（Specialized Non-restrictive Elective Courses of School）

1.课程名称：能源材料

（1）课程编码：3543001

（2）课程简介：能源材料是材料化学本科专业的一门专业任意选修课。能源材料主要介绍世界及中国的能源和消费现状、石化材料的应用、太阳能应用材料、电池、燃料电池、储氢及热电转换材料等。 本课程从分析各种新能源（热能、氢能、太阳能、燃料电池等）的特点出发，学习各种新材料在能源转换中的应用和研究，以及材料基础理论在其中的应用和发展。

1. Course Name: Energy Materials

(1) Course Code:3543001

(2) Brief Introduction of the Course:Energy Materials is one non-restrictive elective course of School of Materials Science and Engineering. It mainly introduces the energy resources and consumption, materials for fossil fuels applications, materials for electricity generation， application of solar energy materials, batteries, fuel cells, hydrogen storage and alternative power generations. From the analysis of all kinds of energy (hydrogen energy, solar energy, fuel cell and the like) characteristics, students will learn the application and research progress of materials in energy conversion and the application and development of materials theories in this field.

2.课程名称：功能高分子多孔材料

（1）课程编码：3543002

（2）课程简介：功能高分子多孔材料是材料化学专业的一门专业选修课程。该课程的内容主要包括聚合物多孔材料的分类，功能化高分子多孔材料的分子设计、制备方法、表征技术和手段以及其在非均相催化、气体吸附，分离工程等应用领域的介绍，加深学生对材料科学当前研究前沿和热点问题的认识。着重介绍功能化多孔材料的物理化学性能与其组成和微观结构之间的关联性，加深学生对材料的功能化特性产生的内在本质理解。通过介绍功能高分子多孔材料的表征手段和分析技术，培养学生综合分析和解决问题的能力，为学生今后从事新材料的研究奠定理论基础。

2.Course Name: Functional Polymer Materials with Porous Structure

(1) Course Code:3543002

(2) Brief Introduction of the Course:Functional Polymer Materials with Porous Structure is an elective course for material chemistry majors. The contents of this course are mainly focused on the introduction of classification of polymeric porous material, the molecular design, preparation and characterization of functional macromolecular porous materials and their potential applications such as catalysis, gas storage and separation science. Through the introduction of the relationship between physical & chemical properties and structure & composition of functional macromolecular porous material, students will strengthen the intrinsic understanding of the functional material and improve their abilities of analyzing and solving problems.

3.课程名称：微纳米材料合成方法

（1）课程编码：3543003

（2）课程简介:《微纳米材料合成方法》是为材料化学专业本科生开设的一门选修课。本课程的目的是帮助学生熟悉制备一维、二维和三维纳米材料的化学和物理方法。重点介绍如何通过水热合成、高温固态反应、共沉淀、化学气象沉积等方法控制微纳米结构材料的形貌、尺寸、孔径以及化学组成等。另外，微纳米材料的应用以及常规表征方法也将在本课程作简单介绍。

3. Course Name: Synthetic Method for the Micro/Nanometer Materials

(1) Course Code:3543003

(2) Brief Introduction of the Course:Synthetic Method for Micro- and Nanomaterials is an elective course for the chemistry materials majors. The aim of this course is to help students be familiar with the chemical and/or physical methods to prepare the nanoscale materials in one, two and three dimensions. How to control the morphology, size, pore size and as well as the composition of micro- and nanomaterials through hydrothermal synthesis, solid state reaction, coprecipitation, chemical vapor deposition etc. will be stressed in this course, while their applications and the usual methods used to characterize these materials will be briefly introduced in this course.

4.课程名称：仿生材料学

（1）课程编码：3543004

（2）课程简介：仿生材料学是材料化学本科专业的一门专业任意选修课。仿生材料学主要受自然界生物特殊结构和功能的启示，模仿或利用生物体结构、功能和生化过程并应用到材料设计，以便获得接近或超过生物材料优异特性的新材料，或利用天然生物合成的方法获得所需材料的一门学科。本课程主要介绍仿生合成的原理，仿生材料的制备与设计，成分和结构材料的仿生，功能和性能仿生，仿生材料的应用。通过对仿生制备材料理论的学习，旨在启发学生了解大自然的规律合成制备新型材料，提高学生的综合理论知识，促进学生对多学科交叉领域中科学研究的兴趣。

4. Course Name: Biomimetic Materials

(1) Course Code:3543004

(2) Brief Introduction of the Course:Biomimetic Materials is one non-restrictive elective course of School of Materials Science and Engineering. It is one discipline that involves in studying the functional materials prepared by the bioinspred concepts from nature. The basic contents including the fundamental theory of bio-synthesis, preparation design and application of biomimetic materials, materials bio-synthesized based on natural structures and properties will be introduced in the course of Biomimetic Materials. This course is aimed to help students grasp functional materials' preparation and application, which will make them study new concepts inspired from nature to design and prepare new materials, and help them have more interesting on materials science.

5.课程名称：涂料化学

（1）课程编码：3543005

（2）课程简介：涂料化学是材料化学本科专业的一门专业任意选修课。主要内容包括：涂料的基本组成及作用的介绍，漆膜的形成及基本性质，涂料中的流变学及其表面改性，涂料树脂合成的聚合反应理论，各种功能涂料（水性涂料，建筑涂料，粉末涂料，防腐蚀涂料等）基本介绍和应用。通过课程的学习，旨在使学生了解涂料的基本理论知识，掌握树脂合成理论和应用，了解涂料的开发过程和市场应用前景，扩宽和提高学生的综合知识，为今后从事相关（涂料，树脂，胶粘剂等）领域的研究工作与开发奠定基础。

5. Course Name: Coating Chemistry

(1) Course Code:3543005

(2) Brief Introduction of the Course:Coating Chemistry is one non-restrictive elective course of School of Materials Science and Engineering. It introduces some basic theories of coatings and their applications in industry. The purpose of Coating Chemistry is to make students learn some fundamental contents including coating rheology, polymerization methods, surface modification, resin synthesis, and functional coatings applied in different fields, which will benefit students to grasp some scientific theories on coatings preparation and applications, and help them work well in some related working or research fields in the future.

6.课程名称：现代表征技术与科技考古

（1）课程编码：3543006

（2）课程简介：现代表征技术与科技考古是材料科学与工程学院的选修课程，是自然科学与人文科学形成的重要交叉方向。课程主要介绍在金属、陶瓷、漆木器、纺织品和动植物类文物中常用的相关表征技术，使学生了解文物样品的前处理，表征技术和数据处理等方法。课程目的在于在前修课程的基础上加深学生对表征技术应用情况的了解，使学生了解古代人类使用材料历史发展脉络，拓展学生的知识面。

6. Course Name: Modern Methods of Analysis and Archaeometry

(1) Course Code:3543006

(2) Brief Introduction of the Course:Modern Methods of Analysis and Archaeometry is an elective course for material chemistry majors in School of Materials Science and Engineering, which is an interdisciplinary science of natural science disciplines and humanities subjects. It introduces the analytical

techniques applied to research metal, ceramic, lacquer or wood, textile and plant or animal heritage and contains three main parts, such as the cultural relics sample pretreatment, the relative analytical techniques and the data processing. The course intents to deepen students' horizon on relative analytical techniques based on the prior courses and broaden their knowledge of those materials once used in ancient times.