# 化工与化学学院

# 学术学位研究生硕博贯通培养方案

# 学科代码：0817 学科名称：化学工程与技术

**1. 培养目标**

面向世界科技前沿、面向经济主战场、面向国家重大需求、面向人民生命健康，立足航天、服务国防，注重理工结合与学科交叉，培养具有家国情怀、社会责任感强、具有较强创新能力和国际化视野、基础理论扎实、专业知识系统、综合素质全面，德智体美劳全面发展，能够独立地、创造性地从事化工领域的科学研究、教学、管理工作，引领化学工程与技术和化学行业未来发展的杰出人才。

**2. 学术学位研究生的基本要求**

1）应具备的基本素质

遵纪守法、品行端正、诚实守信、身心健康，恪守学术规范和学术道德规范；求真务实、严谨治学，具备良好的敬业精神和创新能力；掌握本学科坚实的基础理论和系统的专门知识，有较宽的知识面、较强的自学能力和较突出的综合素质，具有独立从事科学研究或担负专门的技术、生产与管理工作的能力。

2）应掌握的基本知识及结构

掌握化学工程与技术学科坚实的基础理论、系统深入的专业知识，具备一定的学科综合知识和相关交叉学科知识，深入了解学科方向的发展趋势及前沿研究领域。全面掌握学科常用的研究方法、实验技能、测试手段、仪器设备、分析软件、计算机模拟等方法与技术。获硕士学位应至少掌握一门外国语，能熟练运用外语进行文献阅读、论文写作，以及与国际同行进行学术交流，获博士学位还应掌握本领域学术前沿，选题具有较大的理论意义或实际意义，在理论或方法上有创新，对该学科科学研究起到重要作用。

3）应具备的基本学术能力

具有通过系统的课程学习、自学、专业实践、文献阅读等方式获取研究所需知识和方法的能力；具有了解学科发展方向和科学研究前沿的能力；具有从事科学研究工作的能力，能从实践中发现问题、综合运用所学知识分析和解决问题；具有较强的实践能力，具备灵活应用所掌握实验技能、研究方法和仪器设备进行学术研究或技术开发的能力；具备良好的学术表达和学术交流能力。

**3. 研究方向**

1）化学电源与电化学表面技术 2）新能源材料与器件

3）复合高分子界面化学与工程 4）无机功能材料制备及应用

5）表界面化学与工程 6）生物分子科学与工程

**4. 培养年限**

硕博连读研究生基本培养年限为5年；硕士研究生基本培养年限为3年。

**5. 课程体系设置**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 类别 | | 课程编号 | 课程名称 | 学时  课内/实验 | 学分 | 开课  时间 | 备注 |
| 学  位  课  程 | 公共  学位课 | MX61001 | 新时代中国特色社会主义理论与实践 | 32 | 2 | 秋 | 必修 |
| MX61002 | 自然辩证法概论 | 16 | 1 | 春 | 必修 |
| MX71001 | 中国马克思主义与当代 | 32 | 2 | 秋/春 | 博士学位必修 |
| FL62000  FL72000 | 第一外国语 | 32 | 2 | 秋/春 | 必修 |
| 学  科  核  心  课 | MA63002 | 数值分析B | 32/12 | 2 | 秋 | 必修 |
| CC64101 | 表面物理化学**Ⅰ** | 32 | 2 | 春 | 必修 |
| CC64175 | 学术规范及论文写作 | 32 | 2 | 春 | 必修 |
| CC64103 | 高等化工热力学 | 32 | 2 | 秋 |  |
| CC64104 | 化工系统工程 | 32 | 2 | 春 |  |
| CC64201 | 高等物理化学 | 32 | 2 | 秋 |  |
| CC64106 | 量子化学基础 | 32 | 2 | 春 |  |
| CC74022 | 多孔材料制备与表征 | 32 | 2 | 春 |  |
| CC74004 | 电化学科学与应用技术 | 32 | 2 | 秋 |  |
| CC74003 | 结构与物性 | 32 | 2 | 秋 |  |
| CC74002 | 理论和计算化学 | 32 | 2 | 秋 |  |
| CC74006 | 生物分析化学 | 32 | 2 | 秋 |  |
| CC74001 | 固体界面物理与化学 | 32 | 2 | 秋 |  |
| CC74007 | 先进功能材料 | 32 | 2 | 秋 |  |
| CC64107 | 现代电化学 | 32 | 2 | 秋 |  |
| CC64108 | 高等高分子物理 | 32 | 2 | 秋 |  |
| CC64109 | 绿色化学工艺I | 32 | 2 | 秋 |  |
| CC64110 | 催化原理 | 32 | 2 | 秋 |  |
| CC64111 | 生化分析原理与技术 | 32 | 2 | 秋 |  |
| CC64112 | 高等分子生物学 | 32 | 2 | 春 |  |
| CC64113 | 先进化学电源原理与应用 | 32 | 2 | 春 |  |
| CC64114 | 现代电化学表面处理 | 32 | 2 | 秋 |  |
| CC64115 | 新型高分子合成与制备方法 | 32 | 2 | 秋 |  |
| CC64116 | 高分子界面工程 | 32 | 2 | 秋 |  |
| CC64117 | 无机材料物理性能（I） | 32 | 2 | 秋 |  |
| CC64118 | 无机合成技术 | 32 | 2 | 秋 |  |
| CC64202 | 固体化学 | 32 | 2 | 春 |  |
| CC64203 | 物质结构分析 | 32 | 2 | 秋 |  |
| CC64204 | 高等无机化学 | 32 | 2 | 春 |  |
| CC64205 | 高等分析化学 | 32 | 2 | 秋 |  |
| CC64206 | 高等有机化学 | 32 | 2 | 秋 |  |
| CC64207 | 合成化学 | 32 | 2 | 秋 |  |
| CC64208 | 化学模拟理论与方法 | 32 | 2 | 春 |  |
| CC64211 | 波谱学原理与应用 | 32 | 2 | 春 |  |
| CC64212 | 有机合成化学 | 32 | 2 | 秋 |  |
| CC64213 | 物理有机化学 | 32 | 2 | 春 |  |
| CC64214 | 功能材料制备工艺基础 | 32 | 2 | 秋 |  |
| CC64216 | 高等高分子化学 | 32 | 2 | 秋 |  |
| CC64217 | 高分子凝聚态物理 | 32 | 2 | 秋 |  |
| CC64218 | 高分子研究方法 | 32 | 2 | 秋 |  |
| CC64219 | 统计热力学 | 32 | 2 | 秋 |  |
| CC64220 | 群论在化学中的应用 | 32 | 2 | 秋 |  |
| CC64244 | 材料化学与物理 | 32 | 2 | 秋 |  |
| CC64301 | 高等生物化学 | 32 | 2 | 秋 |  |
| 选  修  课  推  荐  列  表 | | PE65001 | 体育健身课 | 32 | 1 | 秋 | 必修 |
| CC64173 | 化工学科发展前沿专题 | 16 | 1 | 春 | 2选1 |
| CC64248 | 化学学科发展前沿专题 | 16 | 1 | 春 |
| CC74010 | 电化学反应工程 | 32 | 2 | 秋 |  |
| CC74011 | 电沉积与化学沉积功能材料 | 32 | 2 | 秋 |  |
| CC74019 | 稀土材料工程 | 32 | 2 | 春 |  |
| CC74020 | 绿色催化化学 | 32 | 2 | 秋 |  |
| CC64129 | 现代电化学测量 | 32 | 2 | 秋 |  |
| CC64130 | 电化学软件应用与模拟计算 | 26/6 | 2 | 秋 |  |
| CC64131 | 材料衍射及波谱分析 | 32 | 2 | 秋 |  |
| CC64132 | 纳米高分子材料 | 32 | 2 | 春 |  |
| CC64133 | 膜科学与技术 | 32 | 2 | 春 |  |
| CC64134 | 先进聚合物基复合材料 | 32 | 2 | 秋 |  |
| CC64135 | 表面分析原理与方法 | 32 | 2 | 秋 |  |
| CC64136 | 反应性与功能高分子材料 | 32 | 2 | 秋 |  |
| CC64137 | 功能陶瓷材料导论 | 32 | 2 | 春 |  |
| CC64140 | 生物医用材料 | 32 | 2 | 春 |  |
| CC64172 | 扫描探针显微技术与纳米加工 | 32 | 2 | 秋 |  |
| CC64221 | 材料热力学 | 32 | 2 | 秋 |  |
| CC64225 | 纳米材料与纳米结构 | 32 | 2 | 秋 |  |
| CC64226 | 分子设计原理与应用 | 16 | 1 | 春 |  |
| CC64229 | 新型无机材料概论 | 16 | 1 | 秋 |  |
| CC64230 | 医用高分子 | 32 | 2 | 春 |  |
| CC64231 | 高分子光化学技术与应用 | 32 | 2 | 秋 |  |
| CC64233 | 光电功能高分子 | 32 | 2 | 春 |  |
| CC64234 | 电子结构理论与计算应用 | 32 | 2 | 秋 |  |
| CC64235 | 第一性原理方法及应用 | 32 | 2 | 秋 |  |
| CC64236 | 分子动力学模拟原理和应用 | 32 | 2 | 春 |  |
| CC64243 | 催化科学与工程 | 32 | 2 | 秋 |  |
| CC64245 | 功能与智能材料——结构演化与结构分析 | 32 | 2 | 春 |  |
| CC64246 | 人工智能化学 | 32 | 2 | 春 |  |
| CC64247 | 超分子化学 | 32 | 2 | 秋 |  |
| CC68301 | 实验动物学 | 16/16 | 2 | 春 |  |
| CC68110 | 物质结构及组成分析实验 | /48 | 2 | 春 |  |
| CC68112 | 研究生综合实验 | /48 | 2 | 春 |  |
| CC68102 | 化学电源制造工程（校内实践基地） | /48 | 2 | 春 |  |
| 必修  环节 | |  | 1.5学年综合测评 |  |  | 秋 | 必修 |
| GS68001 | 社会实践 |  | 1 | 春 |
| CC68101 | 经典文献阅读与学术交流 |  | 2 | 春 |
| CC69101 | 学位论文开题 |  | 1 | 春 |
| CC69102 | 学位论文中期 |  | 1 | 秋 |
| 补修课 | | CC94101 | 电极过程动力学 | 32 | 0 | 秋 | 电化学方向但本科非电化学专业学生必修 |

**说明：**

1. 申请博士学位的研究生总学分要求不少于32学分，申请硕士学位的研究生总学分要求不少于30学分，其中公共学位课5～7学分，学科核心课不少于12学分，选修课不少于8学分，必修环节5学分。

2. 学位课程为考试课程，选修课程可为考查课程（可选本方案所列课程以外，任意外院系的课程）。学术学位研究生课程学习一般应在入学后0.75学年内完成，其中博士政治课一般应在取得博士学籍后学习。

1）课程编号第3位为7的课程，表示博士生课程，如CC74001；课程编号第3位为6的课程，表示硕士生课程，如CC64001。

2）学术规范及论文写作、学位论文开题和学位论文中期的课程编号不区分硕士或博士。申请博士学位的研究生须完成博士学位论文开题及中期检查。申请硕士学位的研究生须完成硕士学位论文开题及中期检查。

3）申请博士学位的研究生应修读不少于4学分的博士层次学科核心课。

3. 对1.5学年综合测评的要求：综合考核学生的课程成绩、导师评价、学术能力和德育情况，综合测评成绩分为优秀、良好、中等、合格和不合格。考核成绩合格及以上可获得1学分，不合格需进行二次测评。考核成绩为优秀、良好的可申请攻读博士学位，考核成绩为优秀的可申请硕士提前毕业（在第四学期末申请答辩）。

4. 对社会实践的要求：具体实践方式参见《研究生社会实践学分实施意见》。

5. 对经典文献阅读的要求：学生至少阅读30篇本学科领域近五年的优秀文献，并在二级学科或课题组做公开学术报告。经典文献目录见文后，目录中的文献阅读至少20篇。学术报告需在开题前完成，并经专家组评议考核通过后获得1学分。

6. 对学术交流的要求：两年内至少参加二级学科或课题组指定的学术交流5次（包括听专家讲学，做学术报告等）或参加学术会议（线上、线下均可）、省部级及以上创新创业竞赛1次（前三名），并提供相关证明材料后获得1学分。

**学院党委意见： 学位评定分委员会意见：**

**签字： 签字：**

**学院意见：**

**签字：**

**日期：**

**附件：**

**学术学位研究生经典文献目录**

**学科代码：0817 学科名称：化学工程与技术**

高分子

1. T. Yokozawa and Y. Ohta. Transformation of Step-Growth Polymerization into Living Chain-Growth Polymerization. Chemical Review, 116: 1950–1968, 2016
2. X. Q. Cheng, Z. X. Wang and X. Jiang et al. Towards sustainable ultrafast molecular-separation membranes: From conventional polymers to emerging materials. Progress in Materials Science, 92: 258-283, 2018
3. Stephen Mann. Life as a Nanoscale Phenomenon. Angew. Chem. Int. Ed., 47: 5306 – 5320, 2008（超标，但经典）
4. A. Ciferri. Translation of Molecular Order to the Macroscopic Level. Chemical Review, 116: 1353–1374, 2016
5. A. Gandini, T. M. Lacerda and A. J. F. Carvalho et al. Progress of Polymers from Renewable Resources: Furans, Vegetable Oils, and Polysaccharides. Chemical Review, 116: 1637–1669, 2016
6. H. Abbasi, M. Antunes and J. I. Velasco. Recent advances in carbon-based polymer nanocomposites for electromagnetic interference shielding. Progress in Materials Science, 103: 319-373, 2019
7. Z. Li, L. Wang and Y. Li et al. Carbon-based functional nanomaterials: Preparation, properties and applications. Composites Science and Technology, 179: 10-40, 2019
8. C. Pramanik, D. Nepal and M. Nathanson et al. Molecular engineering of interphases in polymer/carbon nanotube composites to reach the limits of mechanical performance. Composites Science and Technology, 166: 84-96, 2018
9. L. Liu, C. Jia, J. He et al. Interfacial characterization, control and modification of carbon fiber reinforced polymer composites. Composites Science and Technology, 121: 56-72, 2015
10. J. Karger-Kocsis, H. Mahmood and A. Pegoretti. Recent advances in fiber/matrix interphase engineering for polymer composites. Progress in Materials Science, 73: 1-43, 2015

电化学

1. 克里斯汀·朱利恩［法］，艾伦·玛格［法］，阿肖克·维志［加］. 锂电池科学与技术. 化学工业出版社， 2018
2. Frano Barbir [美]. PEM燃料电池：理论与实践. 机械工业出版社 2016
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4. Obana, B. The irreversible momentum of clean energy. Science, 2017, 355:126-129
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8. Bruce, P. G., Freunberger, S. A., Hardwick, L. J. & Tarascon, J.-M. Li-O2 and Li-S batteries with high energy storage. Nat Mater, 2012, 11:19-29
9. Raccichini, R., Varzi, A., Passerini, S. & Scrosati, B. The role of graphene for electrochemical energy storage. Nat Mater, 2015, 14:271-279
10. Lin, D., Liu, Y. & Cui, Y. Reviving the lithium metal anode for high-energy batteries. Nature Nanotechnology, 2017, 12:194

能源化工

1. M. Faraday, The Bakerian Lecture: Experimental Relations of Gold (and Other Metals) to Light, Phil. Trans. R. Soc. Lond., 147 (1857) 145-181.
2. J. N. Israelachvili, and G. E. Adams, Measurement of Forces between Two Mica Surfaces in Aqueous Electrolyte Solutions in the Range 0-100 nm, J. Chem. Soc. Faraday Trans., 74 (1978) 975-1001.

生物化工

1. Amy Y N, Mason A F, Van H J C M. The Hallmarks of Living Systems: Towards Creating Artificial Cells[J]. Interface Focus, 2018, 8(5):20180023.
2. W Zong, S Ma, et al. A Fissionable Artificial Eukaryote-like Cell Model[J]. Journal of the American Chemical Society, 2017, 139:9955-9960.
3. Li Q, Han X. Self‐Assembled “Breathing” Grana‐Like Cisternae Stacks[J]. Advanced Materials, 2018, 30(25): 1707482.
4. Wang R, Yan M, Li H, et al. FeS2 Nanoparticles Decorated Graphene as Microbial‐Fuel‐Cell Anode Achieving High Power Density[J]. Advanced Materials, 2018, 30(22): 1800618.
5. Nam J, Won N, Jin H, et al. pH-Induced Aggregation of Gold Nanoparticles for Photothermal Cancer Therapy[J]. Journal of the American Chemical Society, 2009, 131(38):13639-13645.
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化学工艺

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4. Minmin Gao, Liangliang Zhu, Connor Kangnuo Peh, et al. Solar absorber material and system designs for photothermal water vaporization towards clean water and energy production. Energy Environ. Sci., 2019, 12, 841
5. Jyotirmoy Mandal, Yanke Fu, Adam C. Overvig, et al. Hierarchically porous polymer coatings for highly efficient passive daytime radiative cooling. Science 2018, 362, 315–319
6. Civan Avci, Inhar Imaz, Arnau Carné-Sánchez, et al. Self-assembly of polyhedral metal–organic

framework particles into three-dimensional ordered superstructures. NATURE CHEMISTRY,2018, 10:78-84

1. Yuqi Zhang, Qianqian Fu, Jianping Ge. Photonic sensing of organic solvents through geometric study of dynamic reflection spectrum. NATURE COMMUNICATIONS 2015, 6:7510
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3. Peng Tao, George Ni, Chengyi Song, et al. Solar-driven interfacial evaporation. Nature Energy. 2018, 3(12): 1031-1041
4. Khalid AlKaabi, Casey R. Wade,Mircea Dinca. Transparent-to-Dark Electrochromic Behavior in Naphthalene-Diimide-Based Mesoporous MOF-74 Analogs. Chem 2016, 1, 264–272
5. Na Li, Pingping Wei, Linan Yu. Dynamically Switchable Multicolor Electrochromic Films. Small 2019, 15, 1804974
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advanced oxidation processes. Journal of Hazardous Materials 2014, 275, 121–135

1. Fenglian Fu a, Dionysios D. Dionysiou, Hong Liu. The use of zero-valent iron for groundwater remediation and wastewater treatment: A review. Journal of Hazardous Materials 2014, 267:194–205
2. Kun Sun, Tao Cheng, Lina Wu, et al. Ultrahigh Mass Activity for Carbon Dioxide Reduction Enabled by Gold−Iron Core−Shell Nanoparticles. J. Am. Chem. Soc. 2017, 139, 15608-15611
3. Wei Gao, Sam Emaminejad, Hnin Yin Yin Nyein, et al. Fully integrated wearable sensor arrays for multiplexed in situ perspiration analysis. Nature 2016, 529:509-526

高分子

1. T. Yokozawa and Y. Ohta. Transformation of Step-Growth Polymerization into Living Chain-Growth Polymerization. Chemical Review, 116: 1950–1968, 2016
2. X. Q. Cheng, Z. X. Wang and X. Jiang et al. Towards sustainable ultrafast molecular-separation membranes: From conventional polymers to emerging materials. Progress in Materials Science, 92: 258-283, 2018
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