# 上海交通大学研究生专业课程信息收集表

## Information Form for SJTU Graduate Profession Courses

<table>
<tr><th colspan="6">课程基本信息 Basic Information</th></tr>
<tr><td>*课程名称<br>Course Name</td><td colspan="5">（中文 Chinese）超分子材料及其生物医学应用<br>（英文English）Supramolecular materials and Biomedical applications</td></tr>
<tr><td>*学分<br>Credits</td><td>2</td><td>*学时<br>Teaching Hours</td><td colspan="3">32（1 学分=16 课时）</td></tr>
<tr><td>*开课学期<br>Semester</td><td>秋季学期 Fall</td><td>*是否跨学期<br>Cross-semester?</td><td>否 No</td><td colspan="2">跨 Spanning over 个学期<br>Semesters（含夏季学期）。</td></tr>
<tr><td>*课程类型<br>Course Type</td><td>专业选修课 Program Elective Course</td><td>*课程分类<br>Course Type</td><td colspan="3">全日制课程 For full-time students</td></tr>
<tr><td>*课程性质<br>Course Category</td><td>专业课 Specialized Course</td><td>课程层次<br>Targeting Students</td><td colspan="3">硕博共用 All graduates</td></tr>
<tr><td>*授课语言<br>Instruction Language</td><td>英文 English</td><td>主要授课方式<br>Teaching Method</td><td colspan="3">课堂教学 In class teaching</td></tr>
<tr><td>*成绩类型<br>Grade</td><td>等第制 Letter grading</td><td>主要考核方式<br>Exam Method</td><td colspan="3">笔试 Written Exam</td></tr>
<tr><td>*开课院系<br>School</td><td colspan="5">材料科学与工程学院</td></tr>
<tr><td>所属学科<br>Subject</td><td colspan="5">材料学</td></tr>
<tr><td rowspan="2">负责教师<br>Person in charge</td><td>姓名 Name</td><td>工号 ID</td><td colspan="2">单位 School</td><td>联系方式 E-mail</td></tr>
<tr><td>窦红静</td><td></td><td colspan="2">材料科学与工程学院</td><td>hjdou@sjtu.edu.cn</td></tr>
<tr><th colspan="6">课程扩展信息 Extended Information</th></tr>
<tr><td>*课程简介<br>(中文)<br>Course Description</td><td colspan="5">（分段概述课程定位、教学目标、主要教学内容、先修课程等；不少于 200 字。）<br>作为近年来一个引人关注的科学领域，超分子科学在从跨越分子生物医学到纳米技术的各个领域中扮演着非常重要的角色。基于超分子相互作用的材料科学在近二十年来得到了长足、关键的发展。科学家们致力于从溶液态到固态下通过超分子相互作用提升材料的性能。随着超分子科学相关理论的发展，基于超分子作用所构筑的高性能材料在多个领域发挥着重要作用，尤其是近年来飞速发展的生物医学领域。基于生物医学材料的基本原则，构筑一种性能理想的生物材料，其关键不仅在于调控材料的力学性能、降解性能和生物活性，更在于模拟生物材料发挥作用的体内仿生环境。众所周知，生物体本质上是基于多种生物分子和超分子作用的多层级自组装体。因而，通过超分子作用设计对天然生物环境刺激具有“响应性”的生物材料是生物医学材料构筑的一种非常有效的方式。<br>与本课程题目所表达的含义相符，本门课程将讲授超分子材料构筑的基本知识和核心原则，并强调这类材料在生物医学领域的应用。<br>**课程学习目标**:<br>学习超分子材料的基本知识。<br>了解超分子材料的生物医学应用。<br>讲授知识的同时结合课堂研究提升英语的学术演讲技能。</td></tr>
<tr><td>*课程简介<br>（English）<br>Course Description</td><td colspan="5">**Course Description**<br>Supramolecular science is an exciting area of science that plays a central role in bringing different disciplines together, ranging from molecular medicine to nanotechnology. Materials science based on supramolecular interactions is an emerging field, which has made important steps forward in the recent twenty years. Much afford is put into the development of supramolecular materials with true materials properties, both in solution and in the solid state. These supramolecular materials are beginning to reach the market in all kind of applications, especially in</td></tr>
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| | biological applications. According to the principle of biomedical materials, ideal biomaterials do not only have to fulfill the biomaterials trinity of tunable mechanical properties, regulation of the degradability and the ease for bioactivity incorporation, but also have to mimic the natural environment where the materials are brought into. Therefore, a modular, self-assembly approach using several supramolecular building blocks is an exquisite way to produce such "responsive" biomaterials which is popular in natural biological systems.<br>As is implied in title, this course will highlight the principles and fundamentals of supramolecular materials with the emphasis of their application in biomedical fields.<br>The duration of this course is eighteen weeks, with one 1.5-hour sessions per week. (or the duration of this course is nine weeks, with two 1.5-hour sessions per week.)<br>**Course Learning Objectives**<br>Gain fundamental knowledge in supramolecular materials<br>Know the biomedical applications of supramolecular materials<br>Upgrade the glossary and English skill in related field |
| *教学大纲<br>(中文)<br>Syllabus | （建议列表形式，各列内容：章节、主要内容、课时数、教学方式等）<br><br>**1 课程引论**：超分子材料及其发展方向，包括尺寸-性能相互关系，纳米材料，本体材料，复合物，混合物，超分子，纳米结构和杂化材料。<br>课堂教学，2 学时<br><br>**2 非共价键相互作用**：弱相互作用，协同键，氢键，Etter规则，自组装，超分子作用，分子构造，范德华力，分子结晶；堆积效率和分子结晶能，超分子作用的主客体设计。<br>课堂教学，2 学时<br><br>**3 寡聚物分子复合物**：分子包结络合物，自组装微囊，大环分子受体；冠醚，环糊精，溶液中离子和分子的相互键合；超分子催化和模拟化酶。<br>课堂教学，4 学时<br><br>**4 由大分子构成的超分子结构**：高聚物的功能化协同作用，多孔金属-有机基质框架，固态纳米反应器中的限域空间设计。<br>课堂教学，4 学时<br><br>**5 物理化学基础**：超分子相形成的热力学基础，吸收，包结作用，包裹作用，其他类型的解吸附和解包封作用。包结形成的理论，共晶和堆积络合物的形成。药物共晶，碘的显色反应。<br>课堂教学，4 学时<br><br>**6 化学传感器**：设计和合成分析传感器中的组装单元。<br>课堂教学，4 学时<br><br>**7 传感器中的离子识别作用**：膜和固态体系中的离子分离作用。<br>课堂教学，4 学时<br><br>**8 超分子材料结构和性能的研究方法**：X射线衍射，结晶的超结构，超结晶，溶液和固态NMR，热分析，相图，吸收实验。<br>课堂教学，4 学时<br><br>**9 卟啉和相关的诊断和治疗试剂**。<br>课堂教学，2 学时 |

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| | **10 分子器件：仿生器件**。<br>课堂教学，2 学时 |
| *教学大纲<br>（English）<br>Syllabus | （须与中文一致，翻译请力求信达雅。）<br><br>**1 *Introduction*: Supramolecular Materials and its main directions.**<br>The size-property relationship (single molecule – nano-sized object – bulk material). Compounds, mixtures, phases and materials. Supramolecular, nanostructured and hybrid materials.<br>One 1.5 h classes<br><br>**2 *Non-valent interactions***. Weak vs labile interactions. Coordination bonds. Hydrogen bonds. Etter's rules. Self-assembly. Supramolecular synthon. Molecular tectonics.<br>Van der Waals interactions. Molecular crystals. Van der Waals radii. Packing efficiency and energy of molecular crystal frameworks. Design of new host geometries.<br>One 1.5 h classes<br><br>**3 *Oligomolecular associates*.** Molecular clathrates. Self-assembling capsules and rosettes. *Macrocyclic receptors*: crown-ethers, cyclodextrins, calixarenes and others. Template effect. Preorganization. Host-guest complementarity. Binding of ions and molecules in solution. Supramolecular catalysis and enzyme mimics.<br>Two 1.5 h classes<br><br>**4 *Supramolecular structures with macromolecules***. Functional coordination polymers. Porous metal-organic frameworks. Confined spaces in solids as nanoreactors.<br>Two 1.5 h classes<br><br>**5 *Physico-chemical basis*** for the formation of supramolecular phases driven by thermodynamics. Sorption, clathration, encapsulation and other types of inclusion behavior. The theory of clathrate formation. The formation of co-crystals and packing complexes. Pharmaceutical co-crystals. Blue reaction of iodine.<br>Two 1.5 h classes<br><br>**6 *Chemosensors*** Synthetic Receptors in Analytical Sensing Applications<br>Two 1.5 h classes<br><br>**7 *Selective Ion Recognition with Durable Sensors*** Ion Separations in Membrane and Solid Phase Extraction Systems<br>Two 1.5 h classes<br><br>**8 *Methods used to study structure and properties of supramolecular materials*** overview. X-ray crystallography. Big unit cells, superstructure and modulation in crystals. Supercrystals. Solution and solid-state NMR. Thermal analysis. Phase diagrams. Sorption experiments.<br>Two 1.5 h classes<br><br>**9 *Porphyrin- and Expanded Porphyrin-Based Diagnostic and Therapeutic Agents***<br>One 1.5 h classes<br><br>**10 *Molecular devices***. Biological mimics.<br>One 1.5 h classes |

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| *课程要求<br>（中文）<br>Requirements | （课程考核方式、考核标准等；不少于 50 字）<br>第一次课程演讲（无PPT演讲）30%；第二次课程演讲（制作PPT演示演讲）30%；期末考试40%。 |
| *课程要求<br>（English）<br>Requirements | （须与中文一致，翻译请力求信达雅。）<br>Speech 30% ; Presentation 30%; Final exam (end of term): 40%. |
| *课程资源<br>（中文）<br>Resources | （教材、教参、网站资料等。）<br>1. Supramolecular chemistry, Chichester, U.K. : Wiley 2nd ed. 2009.<br>2. Self-Assembly in Supramolecular Systems, L. F. Lindoy, I. M. Atkinson, The Royal Society of Chemistry 2000.<br>3. Supramolecular Polymers, Edited by A. Ciferri, Marcel Dekker, Inc. 2000.<br>Homepage in Canvas system during the teaching term. |
| *课程资源<br>（English）<br>Resources | （须与中文一致，请力求信达雅。）<br>1. Supramolecular chemistry, Chichester, U.K. : Wiley 2nd ed. 2009.<br>2. Self-Assembly in Supramolecular Systems, L. F. Lindoy, I. M. Atkinson, The Royal Society of Chemistry 2000.<br>3. Supramolecular Polymers, Edited by A. Ciferri, Marcel Dekker, Inc. 2000.<br>授课学期在Canvas系统建立课程网站。 |
| 备注<br>Note | |