**上海交通大学硕士研究生课程教学大纲**

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| 课程基本信息（Course Information） |
| 课程代码（Course Code） | F160520 | \*学时（Credit Hours） | 32 | \*学分（Credits） |  2 |
| \*课程名称（Course Name） | （中文）碳资源循环科学与技术前沿 |
| （英文）Frontiers in Carbon Cycle Science and Technology |
| 课程性质(Course Type) | 选修课 （Selective） |
| 授课语言(Language of Instruction) | 英文（English） |
| \*开课院系（School） | 中英国际低碳学院（China-UK Low Carbon College） |
| 先修课程（Prerequisite） | 环境科学与工程相关课程（Environmental Science and Technology） |
| 授课教师（Teacher） | 陈熙 (Xi Chen) | 课程网址(Course Webpage) |  |
| \*课程简介（Description） | 本课程将介绍自然界中碳资源循环的基本特点和规律（二氧化碳在大气、海洋和生物圈的循环过程和特点规律），可持续碳资源循环中存在的主要问题（高碳排放、能源结构等），促进碳资源循环利用的前沿技术和方法以及未来发展趋势。主要涉及的碳资源为两大最重要碳资源：生物质和二氧化碳，将较为全面和系统的阐述利用生物质和二氧化碳为碳资源制备燃料和化学品的技术进展与应用前景。生物质的资源化利用技术和方法主要包括生物柴油的炼制、生物质发酵制备绿色燃料、生物质热裂解生产合成气、藻类能源以及其它前沿技术等。二氧化碳的资源化利用技术将涵盖二氧化碳在化工业中的应用、光电催化二氧化碳制备燃气和催化化学转化二氧化碳制备液体燃料等。最后，将会对这些新兴技术将如何影响和构建未来的社会可持续发展进行分析和讨论。 |
| \*课程简介（Description） | This module covers the basic concepts and fundamental principles of natural carbon circulation (among the atmosphere, ocean and biospheres), the major challenges in sustainable carbon circulation, and the state-of-the-art technologies and strategies in carbon resource utilization along with the future trends. The main focus is on two important carbon resources: biomass and carbon dioxide. A systematic illustration will be presented on biomass and carbon dioxide valorization for chemicals and fuels to sustain the society and reduce the reliance on fossil oils. The specific technologies for biomass utilization primarily include biodiesel production, biomass fermentation, biomass pyrolysis, algae biofuels, etc. The common strategies for carbon dioxide utilization involved the industrial techniques for carbon dioxide utilization, photo- and electrochemical conversion, catalytic transformation of carbon dioxide to energy fuels, etc. Lastly, the potentials to integrate these emerging technologies into the industrial applications will be discussed and the blueprint of future sustainable development of the society will be plotted.  |
| 课程教学大纲（course syllabus） |
| \*学习目标(Learning Outcomes) | 本课程的学习目标是希望学生掌握碳资源循环的基本知识、原理和规律，领会碳资源循环的重要意义和其中的主要关键问题，较为系统的了解二氧化碳和生物质资源化利用生产能源和化学品的前沿科学、技术和工艺方法，以及未来的发展趋势。通过该课程的学习为将来从事可持续发展、环境保护相关工作和开展科学研究打下基础，更好地为社会的低碳绿色发展做出贡献。This module aims to provide the students with an understanding in the fundamental knowledges and principles in carbon circulation and sustainable developments, meanwhile, to enhance and reinforce their awareness of environmental protection and sustainable carbon utilization. It also aims to help the students identify the major challenges and problems in renewable carbon circulation, and impart them the industrial and the emerging technologies to utilize biomass and carbon dioxide as carbon resources for chemicals and fuels. The module is to prepare the students for their future participations in environmental-related companies, research institutes and universities, so that they can contribute to shaping a green, low-carbon and sustainable society in the future.  |
| \*教学内容、进度安排及要求(Class Schedule& Requirements) |

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| Week 1 | 碳资源循环绪论Overview of carbon circulation (the concept, circulation pattern, current problems, course outline, etc.) |
| Week 2 | 碳资源地球化学循环The circulations of carbon among the ocean, biosphere and atmosphere |
| Week 3 | 生物柴油Renewable energy from biomass: biodiesel (fundaments, current status, applications, etc.) |
| Week 4 | 生物质发酵Biomass fermentation (history, routes, commercialization, etc.) |
| Week 5 | 生物质热裂解Biomass pyrolysis (pyrolysis types, chemical process, product features, etc.) |
| Week 6 | 生物质气化Biomass gasification (concepts, process design, scale-up, etc.) |
| Week 7 | 藻类生物燃料Algae biofuels (Advantages, cultivation, product types, case studies, etc.) |
| Week 8 | 二氧化碳在化工产业中的利用Carbon dioxide utilization: industrial aspects (the uses in cement plants, enhanced oil refinery, architecture, etc.) |
| Week 9 | 光电催化二氧化碳转化制备燃料Photo- & electrochemical valorization of carbon dioxide (artificial photosynthesis, electrochemical basics, etc.) |
| Week 10 | 二氧化碳的催化转化制备液体燃料Catalytic conversion of carbon dioxide to hydrocarbons (liquid fuel production, catalyst design, etc.) |
| Week 11 | 碳资源循环技术的发展趋势和应用潜力Towards a sustainable future: potentials and trends (summary, analyses and outlook) |

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| \*考核方式(Grading) | 考核方式和成绩占比为：课堂测试Quiz (10%)团队项目Group project (25%)期末考试Final examination (50%)家庭作业和出勤率Homework and class participation (15%) |
| \*教材或参考资料(Textbooks & Other Materials) | 1. Peter Styring, Elsje Alessandra Quadrelli, Katy Armstrong, *Carbon Dioxide Utilisation: Closing the Carbon Cycle*, Elsevier, 2014.
2. Gabriele Centi, Siglinda Perathoner, *Green Carbon Dioxide: Advances in CO2 Utilization*, John Wiley & Sons, 2014.
3. Shibu Jose, Thallada Bhaskar, *Biomass and Biofuels: Advanced Biorefineries for Sustainable Production and Distribution*, CRC Press, 2015.
4. 胡徐腾, *液体生物燃料：从化石到生物质*, 化学工业出版社, 2013.
5. 彭斯震等，中国二氧化碳利用技术评估报告，科学出版社，2017.
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| 其它（More） |  |
| 备注（Notes） |  |

备注说明：

1.课程大纲一般为教师网上填写，填写要求会自动提示；对于新开课程，需要填着纸质大纲，并经院系教学委员会或专业委员会通过。

2．带\*内容为必填项。

3．课程简介字数为300-500字；课程大纲以表述清楚教学安排为宜，字数不限。