先进功能材料前沿 Frontier of advanced functional materials

1. **课堂讲授学时 Lecture Hours** **32h**
2. **课堂实验学时 Laboratory Hours** **0**
3. **课下研讨学时 Colloquia Hours** **2h**
4. **学生课下投入学时 Individual Study Hours** **4h**
5. **学分 Credits** **2**
6. **开课学年学期**（如果有强制性的要求则必须填，否则可以不填）**Occurrence：1st year, 2nd year, 3rd year, 4th year; Autumn, Spring**

3rd & 4th year undergraduate student and 1st year graduate student

7. **先修课程 Prerequisite(s): 必须先修的课程直接写课程编号和课程名称，建议先修的课程在课程名称后用*号标注，并在下一行注明：*Recommended, not required as prerequisite**

   The students should prerequisite the basic knowledge about chemistry and Materials science.

8. **课程概要 Course Description:** 100 字以内，学习内容以学术关键词出现。

The course will invite three Professor from different countries, including Canada, Australia and Saudi Arabia to introduce the recent development of functional materials including the polymeric materials, optoelectronic materials and green materials. Especially, their contribution in Industry 4.0 will also be introduced.

9. **课程预期学习成果 Course Outcomes:** 用数字 1 到 9 列出每一项主要学习成果

1. To help the students know the frontiers of advanced functional materials.
2. To master basic terminology of material science.
3. Oral presentation and discussion in English.
4. To help the students understand research fields for their graduate study.

10. **教学内容与学时分配 Course Content, Laboratories and Laboratory Hours（有则填，没有则不填），Colloquia Hours（有则填，没有则不填）：**各章节目录与学时，实验内容与学时，研讨内容与学时

Prof. Liu Lei

This lecture focuses on “The Mode of Materials, Technology, and Devices for Industry 4.0”, highlighting the development and application of green and sustainable materials toward carbon neutrality. The lecture will introduce advanced concepts in environmentally friendly materials, pollution control technologies, and smart environmental management systems within the

framework of Industry 4.0. Key topics include groundwater management and coupled simulation optimization, site remediation system design, air/water/waste pollution control modeling, and environmental risk assessment. By connecting cutting-edge research with practical engineering challenges, the lecture aims to provide undergraduate and graduate students with an international perspective on green chemistry, sustainable materials, and emerging technologies for carbon-neutral development.

Prof. Omar F. Mohammed

This course provides an advanced introduction to the fundamental principles of materials characterization for students in Materials Science and Engineering (MSE), Applied Physics, Chemistry, and related fields. Throughout the course, students will explore a diverse array of characterization methods and strategies that will deepen their understanding of the behavior of various materials and chemical systems. Key topics covered in the course include optical spectroscopy, electronic transitions, and an introduction to fluorescence spectroscopy, including fluorescence microscopy. Students will also investigate vibrational spectroscopy for molecular analysis, focusing on Infrared and Raman spectroscopies. Additionally, the course will encompass X-ray imaging and detection, as well as scanning and transmission electron microscopy.

Prof. Hao Wang

Carbon fiber reinforced composites are among the most important advanced materials shaping modern industry due to their lightweight, high-strength, and multifunctional properties. From their early development in aerospace applications to today’s rapid expansion into automobiles, wind energy, transportation, and infrastructure, carbon fiber composites are driving a new wave of technological innovation. This lecture will introduce the development history, key advantages, emerging applications, and future challenges of carbon fiber composites, with particular emphasis on opportunities for China in large-scale manufacturing, low-cost production, and next-generation composite technologies. The lecture aims to provide undergraduate and graduate students with a broad understanding of the scientific foundations, industrial trends, and future prospects of carbon fiber composite materials.

11. 考核与成绩评定 **Grading:**

Group Presentation: 30%

Course summary dissertation: 70%

12. **教材，参考书 Text & Reference Book:** 作者，书名，版本，年份，国际标准书号 ISBN

13. 编写教师 **Course Lecturer：**

编写教师 **Course Lecturer**（签字）：

附录：英文课程教学大纲模板