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| *<br>Course Name               | Chinese                                   |                     |   |
|                                | English Hydrogen Technology and Materials |                     |   |
| *<br>Credits                   | 3   | *<br>Teaching Hours |   |
| *<br>Semester                  | Fall                                      | *<br>Cross-se       |   |
| *<br>Course Category           | Specialized Course                        | *<br>Course         |   |
| *<br>Instruction Language      | Chinese                                   | Teaching            |   |
| *<br>Grade                     | Letter grading                            | Exam                |   |
| *<br>School                    |   |                     |   |
| Subject                        |   |                     |   |
| Person in charge               | Name                                      | ID                  | S |
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| *<br>( )<br>Course Description | 200                                       |                     |   |

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| <p style="text-align: center;">*<br/>English<br/>Course Description</p> | <p>This course focuses on the current hot research fields of hydrogen energy, including hydrogen production, hydrogen storage, hydrogen utilization and hydrogen safety technologies. This course will thoroughly and comprehensively cover the physical chemistry and material science theories on electrocatalysis, photocatalysis, photoelectric (thermal) conversion, fuel cell, hydrogen sensitivity and hydrogen embrittlement, as well as the design optimization from raw materials to system. This course will start from the basic concepts and principles of physicochemistry and material science of related reactions, and combine the academic foreground and practical examples of theoretical prediction through material calculation, material experiment, elementary material design and device integration optimization.</p> <p>This course combines the theoretical knowledge with the latest development of each branch discipline field, and strengthens the ability of students to discover, analyze and solve problems based on the problem orientation. At the same time, the course follows the laws of development and innovation of physical chemistry related to emerging hydrogen energy, emphasizing the understanding and utilizing of new principles, new knowledge, new achievements and new applications.</p> <p>After the course, students are expected to master the overall development of hydrogen energy field, relevant technologies and core materials, clarify the path branches of hydrogen energy technology, advantages, disadvantages application scope and conditions of various technical schemes, and understand the latest hydrogen energy technology. It is hoped that a group of outstanding talents with solid professional knowledge, innovation, national pride and international vision and competitiveness for Chinese hydrogen industry will be cultivated by this course.</p> |  |   |   |
| <p style="text-align: center;">*<br/>( )<br/>Syllabus</p>               |   |  |   |   |
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| *<br>English<br>Syllabus | Chapter 1<br>Introduction           | Introduction to the course   | 1 | Narration and interaction | Juan Chen+<br>Authoritative expert |  |
|                          | Chapter 2<br>Hydrogen<br>Production | Hydrogen Technologies  | 1 | Narration and interaction | Fang Song                          |  |
|                          |                                     | Hydrogen from Water  | 4 | Narration and interaction | Fang Song                          |  |
|                          |                                     | Hydrogen Evolution Catalysts at Cathode  | 2 | Narration and interaction | Fang Song                          |  |
|                          |                                     | Oxygen Evolution Catalysts at Anode  | 2 | Narration and interaction | Fang Song                          |  |
|                          |                                     | Photocatalysts and Photoelectrocatalysts   | 2 | Narration and interaction | Fang Song                          |  |
|                          |                                     | Electrolyzer for Water Splitting   | 1 | Narration and interaction | Fang Song                          |  |
|                          |                                     | Assembling and Testing of Electrolyzer for Water Splitting   | 1 | Experimental lesson       | Fang Song                          |  |
|                          | Chapter 3<br>Hydrogen<br>storage    | Introduction to the hydrogen storage technology and related materials, methods, applications and mechanism | 2 | Narration and interaction | Jianxin Zou                        |  |
|                          |                                     | High pressure hydrogen storage and related storage tank, valve and pipeline materials                      | 2 | Narration and interaction | Jianxin Zou                        |  |
|                          |                                     | Low temperature liquid hydrogen storage and related heat insulation materials                              | 2 | Narration and interaction | Jianxin Zou                        |  |
|                          |                                     | Solid state hydrogen storage and related materials   | 2 | Narration and interaction | Jianxin Zou                        |  |
|                          |                                     | Hydrogen storage and transportation: Current states, challenges and perspectives                           | 3 | Narration and interaction | Jianxin Zou                        |  |
|                          |                                     | Mg based solid hydrogen storage materials: Hydrolysis and thermal decomposition properties                 | 1 | Experimental lesson       | Jianxin Zou                        |  |
|                          | Chapter 4                           | Introduction to Fuel Cell  | 2 | Narration and interaction | Jianbo Wu                          |  |

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|                        | Fuel Cell   | ORR Catalytic Materials at Cathode                      | 2 | Narration and interaction | Jianbo Wu                   |
|                        |   | HOR Catalytic Materials at Anode                        | 2 | Narration and interaction | Jianbo Wu                   |
|                        |   | Membrane and Bipolar plate                              | 2 | Narration and interaction | Jianbo Wu                   |
|                        |   | Operation and Failure Analysis of Fuel Cell             | 2 | Narration and interaction | Jianbo Wu                   |
|                        |   | Fabrication and Evaluation of MEA                       | 1 | Experimental lesson       | Jianbo Wu                   |
|                        | Chapter 5 Hydrogen safety   | Technology and materials of hydrogenation station       | 2 | Narration and interaction | Juan Chen + Industry expert |
|                        |   | Overview and basic theory of hydrogen safety management | 2 | Narration and interaction | Juan Chen                   |
|                        |   | Technology and materials for hydrogen detection         | 3 | Narration and interaction | Juan Chen                   |
|                        |   | Material safety in hydrogen environment                 | 3 | Narration and interaction | Juan Chen                   |
|                        |   | Optical performance test of hydrogen detection material | 1 | Experimental lesson       | Juan Chen                   |
| *                      | 50  |   |   |                           |                             |
| Requirements           | 100<br>5 PPT 20 + 30 + 20<br>+ 20 + 10  |   |   |                           |                             |
| * English Requirements | Total score: 100 points<br>(Final presentation 20% + Final thesis 30% + Homework 20% + Attendance 20% + Experiment 10%)   |   |   |                           |                             |
| Resources              | <ol style="list-style-type: none"> <li>1. Kazunari Sasaki, Hai-Wen Li, Akari Hayashi, Junichiro Yamabe, Teppei Ogura, Stephen M. Lyth: Hydrogen Energy Engineering, Springer, 2016.</li> <li>2. Paulo Emilio Miranda. Science and Engineering of Hydrogen-Based Energy Technologies: Hydrogen Production and Practical Applications in Energy Generation. Academic Press. 2018.</li> <li>3. Frano Barbir;Angelo Basile;T. Nejat Veziroglu, Compendium of Hydrogen Energy: Hydrogen Energy, Woodhead Publishing, 2015.</li> <li>4. Bent Sorensen, Giuseppe Spazzafumo, Hydrogen and Fuel Cells: Emerging Technologies and Applications. Academic Press. 2018.</li> <li>5. , , . , . 2018.</li> <li>6. , , , . . 2018.</li> <li>7. [ ] . , , . 2009.</li> </ol> |   |   |                           |                             |
| English                |   |   |   |                           |                             |

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| Resources |  |
| Note      |  |