

## 材料物理 Materials physica

### ● 教师介绍 Faculty



**You-Fen LI (李友芬)**

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Research Field: Inorganic function materials, Inorganic photoelectric materials; Solid Electrolyte; Solar Cells

### Education

PhD, University of Science and Technology Beijing, China, 1999

MSc, University of Science and Technology Beijing, China, 1994

BSc, University of Science and Technology Beijing, China, 1985

### Work Experience

**May, 2001 - present:** Associate Professor  
Beijing University of Chemical Technology

**March, 2006 – September, 2006:** Visiting Scholar  
The Chinese University of Hong Kong

**July, 1997 – May, 2000:** Post-doctor  
The Chinese University of Hong Kong

### Representative Publications

1. Liang-Liang Sun, You-Fen Li\*, Gang Li, Le-Ge Wang and Yao-Yao Tong.  
**Perovskite-type Compounds in Anion-substituted  $\text{LiSr}_{1-0.5x}\text{TiTaO}_{6-x}\text{F}_x$  Electrolyte for Improving Lithium-ion Conduction.** *Ceramics International* 2019, 45: 2381–2384.
2. Shuqiao Hu, You-Fen Li\*, Ru Yang, Gang Li and Xin-Ke Ding, **Structure and Ionic Conductivity of  $\text{Li}_7\text{La}_3\text{Zr}_{2-x}\text{Ge}_x\text{O}_{12}$  Garnet-like Solid Electrolyte for All Solid State lithium Ion Batteries.** *Ceramic International* 2018, 44: 6614-6618.
3. Lege Wang, Zijian Yang, You-Fen Li\*, Ru Yang, Zhigang Dai, Shuqiao Hu, Liangliang Sun and Yaoyao Tong. **Fluorescence Resonance Energy Transfer of  $\text{CaF}_2$ :  $\text{Eu}^{2+}$ ,**

- Tb<sup>3+</sup> Applied to Dye-Sensitized Solar Cells.** *Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy* 2018, 202: 76-80.
4. Lege Wang, You-Fen Li\*, Zhen Wang, Ru Yang, Yaoyao Tong and Liangliang Sun. **Resonant Energy Transfer and Near-infrared Emission Enhanced by Tri-doped Sr<sub>2</sub>SiO<sub>4</sub>: Ce<sup>3+</sup>, Tb<sup>3+</sup>, Yb<sup>3+</sup> Phosphors for Silicon Solar Cells** *Journal of Luminescence*, 2018, 203: 121 – 126.
  5. Lege Wang, You-Fen Li\*, Shi-Hai You, Liangliang Sun and Yaoyao Tong, **A Self-healing Strategy for Inorganic Fillers: Toward Practical Applications of Silicone Resin Treated at High Temperatures for Bonding Ceramic Joints.** *International Journal of Adhesion and Adhesives* 2018, 87: 73-78.
  6. Jia-Qi Zheng, You-Fen Li\*, Ru Yang\*, Gang Li and Xin-Ke Ding, **Lithium Ion Conductivity in the Solid Electrolytes (Li<sub>0.25</sub>La<sub>0.25</sub>)<sub>1-x</sub>M<sub>0.5x</sub>NbO<sub>3</sub> (M = Sr, Ba, Ca, x = 0.125) With Perovskite-type Structure.** *Ceramic International* 2017, 43(2): 1716-1721.
  7. Caiping WANG, LI Youfen\* and ZHANG Yidong, **Preparation of Glass Ceramics Containing CaF<sub>2</sub> by One-step Method and Analysis of the Fluorescent Probe of Eu<sup>3+</sup> Ion.** *Chemical Journal of Chinese Universities* 016, 37(4): 607-612.
  8. Zhi-Gang DAI, LI You-Fen\*, LI Gang and YANG Ru, **Preparation and Down-conversion Luminescent Properties of Tb<sup>3+</sup>, Yb<sup>3+</sup> Co-doped Sr<sub>2</sub>B<sub>2</sub>O<sub>5</sub>.** *Chinese Journal of Inorganic Materials* 2016, 31(10): 1081-1086.
  9. Gang HU and YouFen LI\*, **Synthesis and Characterization of ZrSiO<sub>4</sub> Powders by a Sol-Gel Method.** *Journal of Beijing University of Chemical Technology (Natural Science)* 2015, 42(2): 65-69.
  10. Yu-chun ZHANG and You-fen LI\*, **Preparation and Luminescent Properties of Di-phase Matrix of 3/2-Al<sub>6</sub>Si<sub>2</sub>O<sub>13</sub>/montmorillonite Phosphors.** *Journal of Materials Science & Engineering* 2015, 33(2), 193-196.
  11. You-fen LI\*, QIN Yi-hong and LIU Li-li. **Influence of Fluxes on Luminescent Properties of MgAl<sub>2</sub>O<sub>4</sub>:Eu Synthesized by Solid-state Microwave Method.** *Bulletin of the Chinese Ceramic Society* 2014, 33(5): 1~5.
  12. Shihai YOU and Youfen LI\*, **High Temperature Bonding Performance and Mechanism Analysis of Silicone Adhesive Modified by Inorganic Fillers.** *Journal of the Chinese Ceramic Society* 2014, 42(1):70-74.
  13. Wang Qi and Li Youfen\*. **Preparation and Luminescence Properties of Eu<sup>2+</sup> Doped Alumina /Montmorillonite Materials with Frame Structures.** *Journal of the Chinese Society of Rare Earths* 2014, 32(3): 275-281.
  14. LI You-Fen\*, LI Jie and YANG Jian-Long. **Synthesis and Photoluminescence of β-SiAlON:Eu<sup>2+</sup> Blue Phosphor.** *Chemical Journal of Chinese Universities* 2010,

31(12):2334-2338.

15. Jian-Long Yang, **You-Fen Li\*** and Ji-Ying Wu, **The luminescence characteristics of 3/2-mullite co-doped by Eu and Tb and energy transfer between them.** *Chinese Science Bulletin* 2009, 54(5): 569-573.
16. **You-Fen Li\***, Qing Liu and Weiwei Liu, **Thermal Conductivity of Mullite/ $\text{Al}_2\text{O}_3$  Ceramics Sintered with  $\text{Li}_2\text{O}$ ,  $\text{CaO}$  and  $\text{Y}_2\text{O}_3$ .** *Advanced Materials Research* 2006, 11-12, 129-132.

- **课程介绍 About Course**

This course is mostly established for foreign MS students and it will be taught in English. It is also applicable to those Chinese MS students who are eager to improve their international perspective, fundamental knowledge in material physic design and communication skills in English. The objectives of this course are to help students understand the fundamental theories and knowledge of the physical properties of materials, i.e., crystalline structure of solids, phase diagram and solid phase transformation, mechanical properties, thermal properties, electrical properties and magnetic properties.

**Outlines:**

1. The crystalline structure of solids
2. Phase diagram
3. Solid phase transformation
4. Mechanical properties
5. Thermal properties
6. Electrical properties
7. Magnetic properties

- **课程大纲 Syllabus**

**Instructor:** Youfen Li, Dr./Associate Professor.

**Course Code:**

**Hours:** 32

**Credits:**

**Prerequisites:** Basic physics

**Description:** The objectives of this course are to help students understand the fundamental theories and knowledge of the physical properties of materials, i.e., crystalline structure of solids, phase diagram and solid phase transformation, mechanical properties, thermal properties, electrical properties and magnetic properties.

**Textbook:** 《 Physics of Functional Materials 》 , Hasse Fredriksson, Ulla Åkerlind, ISBN 978-0-470-51757-4, by Integra Software Services Pvt. Ltd, Pondicherry, India, 2008.

**References:** 1) 《 Solid-State Physics 》 , James D. Patterson, Bernard C. Bailey, ISBN-10 3-540-24115-9, by Springer Berlin Heidelberg New York, 2009.

2) 《Materials Science and Engineering: An Introduction》, William D. Callister, Jr., ISBN-13: 978-0-471-73696-7, by Techbooks/GTS, York, PA.

**General Syllabus:**

1. Introduction (1 hour)

The tasks, contents and study methods of material physic

2. The crystalline structure of solids (8 hours)

Atomic structure, Molecular structure, Crystal concepts, Substitutional and interstice solid solutions, Crystal defects.

3. Phase diagram (6 hours)

Concepts of phase, Cooling curve and Phase diagram, One component diagram, Binary diagrams, Analysis of phase diagram, Lever rule, Gibbs phase rule and Ternary phase diagram.

4. Solid phase transformation (6 hours)

Concepts of phase transformation, The Kinetics of Phase Transformations, Metastable Versus Equilibrium States, The Iron–Iron Carbide (Fe–Fe<sub>3</sub>C) Phase Diagram, Microstructural and Property Changes in Iron–Carbon Alloys, Mechanical Behaviour of Iron–Carbon Alloys

5. Mechanical properties (3 hours)

Definition of Stress and Strain, Tension Tests, Compression Tests, Shear and Torsional Tests, Elastic Deformation, Plastic Deformation, Tensile properties, Hardness,

6. Thermal Properties (3 hours)

Heat Capacity, Thermal Expansion, Thermal Conductivity, Thermal Stresses

7. Electrical properties (3 hours)

The Free electron model, Experimental electrical resistivity of metals, The hall effect, Nearly free electron model, Energy band structures in solids.

**Grading:** Project 20%; Homework 30%; Final exam 50%.

- 教案      Teaching Plan
- 视频      Video