

## Frontiers in Materials Science

Department: Fudan International Summer Session

<b>Course Code</b>	MATE170002		
<b>Course Title</b>	Frontiers in Materials Science		
<b>Credit</b>	2	<b>Credit Hours</b>	36+3 tutorial hours (one credit hour is 45 minutes)
<b>Course Objectives</b>	This course is designed for senior undergraduates to learn about the contemporary frontiers of materials science fields with a goal of expanding their knowledge scope, advancing their capability of scientific report and presentation, and establishing their basic knowledge of research areas at Department of Materials Science.		
<b>Course Requirements:</b> <b>Prerequisites:</b> The prerequisite courses are General Chemistry, Physics, and Introduction to Materials Science.			
<b>Teaching Methods:</b> Lecture, presentation, group discussion			
<b>Instructor's Academic Background:</b>  Ziqi Liang obtained his Ph.D. from Polymer Science in the Department of Materials Science and Engineering at Pennsylvania State University in March 2006. He then pursued postdoctoral work at the University of Cambridge from May 2006 to 2008. In June 2008, he joined the National Research Energy Laboratory as a postdoctoral researcher, later to become Scientist III. In September 2012, he joined the Department of Materials Science at Fudan University as a professor. Currently, Prof. Liang's group conducts research on organic and perovskite solar cells, as well as organic and hybrid thermoelectrics.  Email: <a href="mailto:zqliang@fudan.edu.cn">zqliang@fudan.edu.cn</a>			

## **Course Schedule**

Preface Introduction

Chapter 1 (Opto) Electronic Materials

- 1.1 Basics of Electronic and Photonic Materials
- 1.2 Photovoltaic Materials
- 1.3 Light-emitting Diode Materials
- 1.4 Field Effect Transistor Materials
- 1.5 Sensing Materials
- 1.6 Piezoelectric Materials
- 1.7 Mechanisms of Charge and Photon Transport

Chapter 2 Microelectronic Materials

- 2.1 Introduction of Microelectronic Materials
- 2.2 Photoresist Materials and Applications in Integrated Circuits
- 2.3 Low-Dielectric Materials
- 2.4 High-Dielectrics Materials

Chapter 3 Energy Materials

- 3.1 Overview of Energy Materials and Applications
- 3.2 Battery Materials
- 3.3 Supercapacitor Materials
- 3.4 Thermoelectric Materials
- 3.5 Hydrogen Storage Materials

Chapter 4 Biomaterials

- 4.1 Biomaterials and Applications
- 4.2 Metal Based Biomaterials
- 4.3 Ceramic Based Biomaterials
- 4.4 Biopolymer Materials
- 4.7 Recent Advances in Biomaterials

Chapter 5 Materials Synthesis and Characterization

- 5.1 Synthesis and Preparation of Materials
  - 5.1.1 Nano-materials

- 5.1.2 Ceramics
- 5.1.3 Composite Materials
- 5.1.4 Thin Film Materials
- 5.2 Materials Analysis and Characterization
  - 5.2.1 Element and Component
  - 5.2.2 Chemical Functional Groups
  - 5.2.3 Crystallization and Ordering
  - 5.2.4 Topography and Morphology
  - 5.2.5 Surface and Interfaces

**The design of class discussion or exercise, practice, experience and so on:**

The course requires active class attendance, free discussion, intensive reading, timely completion of assignments such as reports and presentations.

**Grading & Evaluation:**

Discussion 30%

Report 30%

Presentations 40%

There will be no make-up exam.

**Teaching Materials & References:**

A. K. Shukla, Bulletin of Materials Science, Academy of Sciences, 1979-2012.

Raj, B., *Frontiers in Materials Science*. Universities Press: 2007-2012.

Relevant handouts will be provided in class for suggested reading.