

Synthesis of Polymers for A Better World

Department: Fudan International Winter Session 2026

Course Code	MASE50014.01						
Course Title	Synthesis of Polymers for A Better World						
Credit	3	Experiment (Including Computer) Credit	0	Practice Credit	0.5	Aesthetic Education Credit	0
Credit Hours	48 credit hours in total+3 office hours (one credit hour is 45 minutes)	Education on The Hard- Working Spirit Credit Hours	0	Language of Instruction	EN	Honors Course	☐ Yes ☒ No
Course Type	☐ Core General Education Course ☐ Specific General Education Course ☐ Basic Course in General Discipline ☒ Others			2+X Major : ☐ Professional Core Course ☒ Professional Advanced Course Non 2+X Major : ☐ Professional Compulsory Course ☐ Professional Elective Course			
Course Objectives	To understand the basic concepts of polymers and polymerizations; to understand different polymerization mechanisms; to recognize the compatibility of monomers with various polymerization mechanisms/reaction conditions; to know different bulk industry polymers and their corresponding synthetic routes; to have general concepts about commodity polymers, engineering polymers, high-performance polymers and various functional polymers.						
Course Description	Over the last century, polymeric materials have transformed our lives. Modern transportation systems, much of medical applications and the entire electronics and computer industry would not be possible without polymers. In order to understand the nature of these materials and why they are ubiquitous in modern society, this course will provide students with a basic knowledge of the polymers, structure, synthesis and properties of these materials, starting with general concepts of polymer chemistry such as synthetic rubbers, thermoplastics, thermosets and fibers. Students will discover the difference among various polymerization techniques. The majority of this course will						

	discuss different polymeric materials such as commodity polymers, engineering polymers, high-performance polymers and functional polymers. Last but not least, the course will make students aware of a number of contemporary global concerns about the use of polymers in general and some polymers (and additives) in particular, and provide some potential directions for the polymers for a better world.			
Course Requirements: General chemistry; organic chemistry.				
Teaching Methods: Class lectures and class discussion. Social activity: visiting the world well-known polymer companies.				
Course Director's Academic Background: XiangCheng Pan is an associate professor and principal investigator in the State Key Laboratory of Molecular Engineering of Polymers and the Department of Macromolecular Science at Fudan University. In 2014, he obtained his Ph.D. in organic chemistry from the University of Pittsburgh under the guidance of Prof. Dennis P. Curran. He then spent three years of postdoctoral research at the group of Krzysztof Matyjaszewski at Carnegie Mellon University. In 2017, he returned to China and joined Fudan University. The research interest of his group focuses on the development of novel polymerization methods and sustainable polymers. XiaYun Huang is the Associate Professor in the Department of Macromolecular Science at Fudan University. She obtained her Ph.D. in 2014 from Texas A&M University. After times as postdoc research associate in Experimental Soft Matter Lab at Texas A&M University, she joined the Fudan University in 2016 and promoted to the Associate Professor in 2021. She is an awardee of Shanghai Pujiang Talent Program in 2018 and her research interests focus on the fabrication of well-defined nanostructure via precise assembly and the applications.				
Instructor's Academic Background: See above				
Members of Teaching Team				
Name	Gender	Professional Title	Department	Responsibility
Pan, Xiangcheng	Male	Professor	Department of Macromolecular Science	Lecture on structure, synthesis and properties of polymers, general concepts of polymer chemistry, thermoplastics, thermosets and fibers
Huang, Xiayun	Female	Associate Professor	Department of Macromolecular	Lecture on different polymeric materials such as commodity

			Science	polymers, engineering polymers, high-performance polymers and functional polymers

Course Schedule:

	Classes	Course Content	Teacher
1	3	Course overview, historical overview of polymer synthesis and polymeric material. Natural and synthetic rubbers, thermoplastics and thermosets, fibers.	Xiangcheng Pan
2	3	Basic concepts of polymers and polymerizations (MW, MWD, step growth, chain growth). Step growth polymerization.	Xiangcheng Pan
3	3	Free radical polymerization. Cationic and anionic polymerization.	Xiangcheng Pan
4	3	Commodity polymers: polyolefin, LDPE, HDPE, and polystyrene.	Xiayun Huang
5	3	Engineering polymers: PC, ABS, PET and others.	Xiayun Huang
6	3	Exam 1.	
7	3	High-performance polymers: PEEK, F-polymers, PI and others.	Xiayun Huang
8	3	Functional polymers: membrane, ion exchange resin, liquid crystal, flame-resistant polymers.	Xiayun Huang
9	3	Advanced polymeric material: drug delivery, flexible electronic devices, artificial skin.	Xiangcheng Pan, Xiayun Huang
10	3	Sustainable, bio-degradable and environment friendly polymers.	Xiangcheng Pan, Xiayun Huang
11	3	Social exercise/practice.	Xiangcheng Pan, Xiayun Huang
12	3	Exam 2.	
13	3	Social exercise/practice.	Xiangcheng Pan, Xiayun Huang
14	3	Discussion.	Xiangcheng Pan, Xiayun Huang
15	3	Discussion.	Xiangcheng Pan, Xiayun Huang
16	3	Final term paper.	

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

The student is asked to give a presentation about specific polymeric material (property, application, synthetic method and so on) in the class discussion section. In the social exercise and practices, the students have the opportunity to visit Covestro and Dow Chemical to have a better understanding how polymers making a better world.

If you need a TA, please indicate the assignment of assistant:

Yes, ranking the quiz and exam.

Grading & Evaluation:

Quiz: 10%

Exam: 15%, 15%

Presentation: 20%

Term paper: 40%

Usage of Textbook: ☐ Yes (complete textbook information form below) ☒ No

Textbook Information (No more than two textbooks) :

Title	Author	ISBN	Publishing Time	Publisher	Type I	Type II

Teaching References:

Robert. J Young, Peter. A. Lovell. *Introduction to Polymers*. 3rd ed. CRC Press., 2011. ISBN. 9780849339295

Odian, George. *Principles of Polymerization*. 4th ed. Hoboken, NJ: Wiley-Interscience, 2004. ISBN: 9780471274001.

Flory, Paul J. *Principles of Polymer Chemistry*. Cornell University Press, ISBN: 7-5062-6016-6.

Cowie, J.M.G., Arrighi, V., *Polymers: Chemistry and Physics of Modern Materials*. 3th ed. China Machine Press. ISBN: 978-7-111-44888-4.