MSE 3230 Polymer & Fiber Processing

Credit hours and contact hours: 3-0-0-3

Instructor: Donggang Yao

Textbook: Z. Tadmor and C.G. Gogos, *Principles of Polymer Processing*, Wiley-Interscience, 2nd Edition, 2006.

Specific course information

Catalog description: Discussion of the principles of fiber formation from polymers including rheology, mechanics, energetics, phase transition, and polymer structure. High-performing fiber processing, and plastics processing.

Prerequisites: MSE 3225 – Rheology and MSE 4775 - Polymer Science & Engineering I

Course: Selected Elective

Specific goals for the course

Outcomes of instruction:

1. Analyze mass and heat transfer problems in simple geometries (e.g. 1-D or axisymmetric) for polymeric materials during polymer/fiber processing.
2. Understand the structural-property relationship and interpret the influence of processing on the structural development during polymer/fiber processing.
3. Select suitable polymer/fiber processing techniques and sequences for product realization.
4. Apply CAD and CAE for solving polymer/fiber engineering problems.

Student Outcomes:

(1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.

(2) An ability to apply engineering design to produce solutions that meet specified needs with consideration for public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
(6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

Topics covered:

1. Introduction: basics and general background

2. Overview of polymer processing
3. Review of continuum mechanics
4. Thermal, mechanical and rheological properties pertinent to polymer/fiber processing
5. Isothermal flow of purely viscous non-Newtonian fluids
6. Non-isothermal aspects in polymer/fiber processing
7. Melting
8. Pressurization and pumping
9. Mixing
10. Devolatilization
11. Extrusion
12. Injection molding
13. Reactive polymer processing
14. Fiber spinning

Correlation between Outcomes of Instruction and Student Outcomes:

Outcomes of Instruction	Student Outcomes						
	1	**2**	**3**	**4**	**5**	**6**	**7**
1. Analyze mass and heat transfer problems in simple geometries (e.g. 1-D or axisymmetric) for polymeric materials during polymer/fiber processing.	X						
2. Understand the structural-property relationship and interpret the influence of processing on the structural development during polymer/fiber processing.	X	X					
3. Select suitable polymer/fiber processing techniques and sequences for product realization.		X					
4. Apply CAD and CAE for solving polymer/fiber engineering problems.						X	

School of Materials Science and Engineering Student Outcomes:

(1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
(2) An ability to apply engineering design to produce solutions that meet specified needs with consideration for public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
(3) An ability to communicate effectively with a range of audiences.
(4) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
(5) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.

(6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
(7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.