

## ***SYLLABUS: POLYMER PROCESSING***

20 MTEN 625 001 MWF 10-10:50 Rhodes 513

= To TOC

Quarter: Winter, 1999-2000

LEVEL: Dual (Focused on Undergraduate but Graduates can take course for Grad. Credit)

Instructor: Prof. Gregory Beaucage  
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556-3063/-5152(Lab)/-9305(Lab)

540 ERC/551 ERC and 410 Rhodes (Labs)

<http://www.eng.uc.edu/~gbeaucag/BeaucageResearchGroup.html>

Textbook: "Principles of Polymer Processing" by Z. Tadmor and C. G. Gogos

Xerox copies are available from other students as the text is quite expensive (in paperback at \$130 from [Amazon.com](http://www.amazon.com) search "Tadmor" 4 day delivery).

This is by far the best book on this subject.

Notes/Labs/Homeworks (HW's Not Graded) on Web in html and pdf format:  
<http://www.eng.uc.edu/~gbeaucag/Classes/Processing.html>

Synopsis of Course: The main topics involved in the processing of polymers will be explored. These include a brief review of transport phenomena and basic rheological equations, more specialize approaches to polymer rheology and application of these approaches to unit operations in polymer processing.

**4 to 5 labs** will take the place of some class meetings.

1. Review (Chapters 1-4).

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Basic processing aspects of Polymer Science. Chapters 1-4 should have been mostly covered in Introduction to Polymer Science.

2. Transport Phenomena (Chapter 5).

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Vectors and tensors in rheology. Continuity equations for mass, momentum and energy. Common assumptions for continuity equations. Reynolds' Equation. Deborah Number (eqn. 2.1-5) and molecular weight dependence of zero shear rate viscosity (fig. 2.3). Constitutive equations.

3. Polymer Melt Rheology (Chapter 6).

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Models for non-Newtonian behavior.

4. Mixtures and Mixing. (Chapter 7).

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Modeling of mixing in inhomogeneous systems common to polymer processing.

5. Mixing Operations (Chapter 11).

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Batch vs. continuous. Laminar mixing. Models for homogenization, dispersion. Motionless mixers, roll mills, batch mixers, screw extruders as mixers.

6. Pressurization and Pumping (Chapter 10).

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Models for the important pressurization methods in polymer processing. Screw pump, calendars and roll-mills, normal stress pressurization, plunger-cylinder, gear pumps, and twin screw extruders.

7. Screw Extruder (Chapter 12).

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Modeling of the single screw extruder using topics we have discussed.

### **COURSE REQUIREMENTS**

70% Quizzes and Final.

Quiz Every 3<sup>rd</sup> Lecture Meeting. (Labs will take up 4 to 5 lecture slots)

Comprehensive Final Covering Labs, Quizzes and Homework (homeworks are not graded)

Final equivalent to 3 quizzes in weight.

30% Lab Reports.

*All Exams Closed Book and Notes.*

**NOTE:** Since this is a dual level course being given for undergraduate or graduate credit the final grade for undergraduate credit will be boosted by about half a grade (5-10 points) after the final grades have been calculated.