

Ceramic Engineering 369 Glass Science & Engineering

Semester: Fall 2011
Course: Cer 369 (Reference number: 72147)

Course meeting: M-W-F, 10:00-10:50 AM, McNutt 243
Course Instructor: Richard K. Brow
Office/phone/e-mail: 322McNutt/341-6812/brow@mst.edu
Office hours: 8:00AM-9:30, M-W-F; and any other time that can be arranged- e-mail requests are the best way to set up a meeting.

Course Text: There is no assigned text for this course. Copies of articles from the *GlassResearcher*, the *Handbook of Ceramics, Glasses and Diamonds* (2001), from the *Engineered Materials Handbook* Vol. 4, ASM Intl. (1991), and other technical references will be distributed to supplement lecture materials. These articles will be distributed in class a week or so before they are discussed. Copies of the PowerPoint slides used in lectures will be posted on the class Blackboard site, as will be other documents related to the course.

Supplemental material: *Handbook of Glass Manufacturing*, F. V. Tooley (1984); *Fundamentals of Inorganic Glasses*, 2nd ed., A. K. Varshneya (2006); *Commercial Glasses, Advances in Ceramics*, Vol. 18, 1986.

Homework/Projects: Students are encouraged to read the articles listed in the attached course outline *prior to* the indicated lecture. There will be several class projects on which your grade will be based:

- Quick-quiz on definitions of glass (due 8/29 – 50 points)
- Quick quiz on the Uhlmann paper (due 9/7 – 50 points)
- Take-home exam on glass formation, crystallization and phase separation (due 9/21 - 200 points)
- Quick reports on unusual glass-forming systems (due 10/5 – 100 points)
- Class presentation on manufacturing specific glass products (due 10/26 - 200 points)
- Individual report on glass surface characterization (due 11/19 - 200 points)
- Team report/presentation on a manufacturing problem, based on our plant trip (due 12/6 - 200 points).
- Final (take-home) exam (due 12/15 – 200 points)

We will also have short quizzes/assignments related to the assigned readings or class topics throughout the semester.

We will visit a glass manufacturing facility late-October/early-November. This trip will cost each student about \$30 (for travel and meals).

Grading: Grades will be based on the following ‘points distributions’.

<u>Grade</u>	<u>% total points</u>
A	90-100%
B	80-89%
C	70-79%
D	60-69%
F	<60%

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Course Objectives: Students will understand the scientific and technological descriptions of inorganic glasses (amorphous solids), review the engineering principles behind the commercial manufacture of a variety of glass products, and understand how glass surfaces control important engineering properties. Students will apply basic principles of thermodynamics and kinetics in these undertakings.

Course Content:

- *Definitions, concepts of glass formation, microstructure (1/3)
- *Manufacturing and commercial products (1/3)
- *Glass properties and surfaces (1/3)

Academic Alert System: <http://academicalert.mst.edu>

The online Academic Alert System will be utilized. The purpose of the Academic Alert System is to improve the overall academic success of students by improving communication among students, instructors and advisors; reducing the time required for students to be informed of their academic status; and informing students of actions necessary by them in order to meet the academic requirements in their courses.

Academic Dishonesty: <http://registrar.mst.edu/academicregs/index.html>

Page 30 of the Student Academic Regulations handbook describes the student standard of conduct relative to the System's Collected Rules and Regulations section 200.010, and offers descriptions of academic dishonesty including cheating, plagiarism or sabotage. This standard will be employed for this class.

Classroom Egress Maps:

Students should familiarize themselves with the classroom egress maps posted on-line at: <http://registrar.mst.edu/links/egress.html> .

Disability Support Services: <http://dss.mst.edu>

Any student inquiring about academic accommodations because of a disability should be referred to Disability Support Services so that appropriate and reasonable accommodative services can be determined and recommended. Disability Support Services is located in 204 Norwood Hall. Their phone number is 341-4211 and their email is dss@mst.edu. Instructors may consider including the following statement on their course syllabus as a means of informing students about the services offered:

"If you have a documented disability and anticipate needing accommodations in this course, you are strongly encouraged to meet with me early in the semester. You will need to request that the Disability Services staff send a letter to me verifying your disability and specifying the accommodation you will need before I can arrange your accommodation."

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TENTATIVE SCHEDULE (FS11)

Date	Lecture Topic	Relevant Reading Material
8/22	No Class/RKB Travel;	Wright and Varshneya articles
8/24	No Class/RKB Travel	
8/26	No Class/RKB Travel	
8/29	Class organization; introduction	Zachariassen/Warren papers
8/31	Review- glass structure	
9/2	Review- glass structure	
9/5	No class, Labor Day	
9/7	Concepts of glass formation; Nucleation/crystallization review	Uhlmann article
9/9	Critical Cooling Rates/TTT diagrams for Glass Formation	
9/12	Liquid-Liquid Immiscibility: thermodynamics	Cahn article
9/14	Mechanisms for phase separation, applications	
9/16	Glass-Ceramics (1)	Beall & Pickney article
9/19	Glass-Ceramics (2)	
9/21	Take-Home Test Due – Glass-Ceramic Application Reports	
9/23	DTA techniques	Ray et al. articles
9/25	Glass Compositions; review of random network structure;	Varshneya (5.1-5.23)
9/28	Network structures of oxide glasses; Acid-Base Concepts	
9/30	Compositions/Commercial Glasses (1)	Seward Article (6.1-6.29)
10/3	Compositions/Commercial Glasses (2)	
10/5	Quick reports – Unusual Glass Forming Systems	
10/7	Raw materials; Batch reactions	GlassResearcher, 7(2) 1998 GlassResearcher, 8(1) 1998
10/10	Melt Reactions	
10/12	Refractories	
10/14	No class- MS&T Meeting	
10/17	No class- MS&T Meeting	
10/19	No class- MS&T Meeting	
10/21	Melting and Forming	Seward Article (6.67-6.95)
10/24	Melting and Forming	
10/26	Manufacturing Assignments (1)	
10/28	Manufacturing Assignments (2)	
10/31	Manufacturers Field Trip:	
11/2	Melt properties- viscosity	Mauro et al. article
11/4	Melt properties- other thermal and electrical properties	
11/7	Viscoelasticity review	Seward Article (6.96-6.117)
11/9	Strain & Annealing;	
11/11	Glass Surfaces: introduction, thermodynamics	Rupertus & Bange article
11/13	Characterization Techniques	
11/16	Chemical durability; dissolution and ion exchange	Paul article
11/18	Surface Report Due Corrosion reactions; thermodynamics	
11/21	No class, Thanksgiving Holiday	
11/23	No class, Thanksgiving Holiday	
11/25	No class, Thanksgiving Holiday	
11/27	Weathering reactions and coatings	
11/30	Glass color	
12/2	Glass color	
12/4	Glass color	
12/6	Manufacturing Field Trip Report	
12/15	Final Exam	