



RUTGERS
UNIVERSITY

Department of Materials Science and Engineering

Advanced Glass 16:150:505

Professor Lehman [rillehman@rci]

Fall Term 2007

MW 3:20 – 4:40 ARC-203

This course provides the student with an advanced understanding of the structure, properties and selected processing of glasses, with special emphasis on the transport properties of silicate glasses. The structure of some simple glasses is evaluated by statistical techniques and several thermodynamic quantities are calculated. Glass transport properties are discussed and related to the structural mechanisms responsible for these properties. Advanced processing issues are selectively addressed.

Textbook: R. H. Doremus, Glass Science, John Wiley, (1994). ISBN 0-471-89174-6

Grade Basis:

Mid-Term Examination	Wednesday October 24	30%
Final Examination	December 12	40%
Assignment and Presentation	December 10	20%
Other: Quizzes	As announced	10%

Week	Title	Description
1	Glass formation and structure.	An overview of the bonding and MO_4 structure of silicate and phosphate networks. Glass formers, intermediates and modifiers in the periodic table.
2	The Glass Transition and Viscosity	Structural and experimental aspects of the transition. Viscous flow, Viscosity Temperature Relationships, Viscosity Benchmarks, Crystallization Rates, Liquidus Behavior
3	Types of Glasses and their properties	Silica and Silicate Glasses, Borate and Borosilicates, Compositions For Flat, Container, Fiber, and Specialty Glasses.

6	The random network model of glass structure	Radial distribution functions. Models of Glass Structure. The random network model. Crystallite models. Statistical thermodynamic techniques for modeling glass structure.
7	Review and Exam	
8	Heat capacity. Thermal Conductivity	The role of structure in thermal properties
9	Statistical Models	The Sphere of Influence Glass Model
10	Statistical Models	Results of glass modeling
11	Phase separation	Phase separation from an experimental and theoretical perspective
12	Design, Strength, Mechanical Properties	Theoretical and practical strengths, probabilistic design, Weibull statistics, hardness, bulk versus fiber properties
13	Chemical Durability	The chemical durability of glass in various environments, weathering.
14	Review and Exam	