**CHEMISTRY 327**
**CERAMICS**
**SPRING 2007**

**INSTRUCTOR:** Maria A. Gomez, Carr G22C, magomez@mtholyoke.edu
Office hours: Tu 1-2 PM, W 2-3 PM, Th 3-5 PM or by appointment.

**TEXT:** Yet-Ming Chiang, Dunbar Birnie III, and W. David Kingery, *Physical Ceramics: Principals for Ceramic Science and Engineering*, The MIT Series in Materials Science and Engineering 1997. ISBN 0-471-59873-9.

**WEB:** http://www.mtholyoke.edu/courses/magomez/Ceramics

**HOURS:** Tu, Th 8:35-9:50

## COURSE DESCRIPTION

Ceramics are inorganic non-metallic crystals displaying a wide range of material, electrical and magnetic properties. This course examines the structural motifs adopted by ceramics, how defects in these structures lead to deviations from the motifs, and how mass and charge balance requirements lead to mass and electrical transport.

## GRADING POLICY

Grading will be based on five problem sets and one paper. Problems sets are due on * days in the schedule. Late assignments will not be accepted. In lieu of a final, you will write a paper describing the structure, defects and transport in your assigned system. Systems will be assigned on the second day of class. Your paper should review the current literature on each of these aspects for your assigned system and propose a new direction. To encourage you to start on this paper early, some problem set questions will ask you to discuss new class concepts in the context of your assigned system.

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| Problem Sets (5): | 75% |
| Paper in lieu of final: | 25% |

## Class Schedule

| *Topic* | **DATE** | *Readings* |
|---|---|---|
| Introduction | *9/4* | |
| **I. Structure of Ceramics** | | |
| Closed-packed lattices are the basic skeletons. | *9/9* | 1.1 |
| Pauling's rules provide empirical guidelines for understanding the stability of ionic crystal structures | *9/11,9/16* | 1.2 |
| Visualizing the basic types of crystal structures | *9/18, 9/23* | 1.3 |
| The radial distribution function is a probe of structure | *9/25** | 1.4, 1.5 |
| Potential energy surfaces | *9/30, 10/2, 10/7* | Literature |

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| **II. Defects in Ceramics** | | |
| Point defects | *10/9, 10/16, 10/21** | 2.1 |
| Simultaneous defect equilibria | *10/23* | 2.2 |
| Line and planar defects | *10/28* | 2.5 |
| Computational methods of treating defects | *10/30, 11/4*, 11/6* | Literature |
| **III. Mass and Electrical Transport** | | |
| Diffusion and Fick's Laws | *11/11, 11/13* | 3.1 |
| Diffusion at the atomic level | *11/18*, 11/20* | 3.2, Literature |
| Electrical conductivity | *11/25, 12/2* | 3.3 |
| The electrochemical potential | *12/4* | 3.4 |
| Computational methods for treating transport | *12/9*, 12/11* | Literature |