

MSE 102: Bonding, Crystallography and Defects
Syllabus – Fall Semester, 2019
Instructor: Professor Daryl C. Chrzan

<u>Date</u>	<u>Topic</u>	<u>Problem Sets</u>
08/28	No Class. Work through mathematical background notes and practice problems.	
<u>Part I: Symmetry, Crystallography and Crystal Structures</u>		
09/03	Introduction to lattices. Coordinates, directions, planes. B.-O. Ch. 2, KGK Ch. 1, R, Ch. 2, S Ch.1	
09/05	Lattices continued, introduction to symmetry operations. B.-O. Ch. 5, R Ch. 3, S Ch. 2	PS #1 Due
09/10	Symmetry operations, symmetry operations compatible with lattice translations.	
09/12	Improper rotations, glide planes, screw axes. 2D plane lattices.	PS #2 Due
09/17	3D Bravais lattices; Introduction to crystal structures. B.-O. Ch. 3&6	
09/19	Crystal structures: Lattice+basis. Stereographic projections. KGK Ch. 2	PS #3 Due
09/24	32 crystallographic point groups. 230 space groups.	
09/26	Introduction to the International Tables for Crystallography.	PS #4 Due
10/01	Relationship between symmetry and physical properties: Reciprocal lattices and diffraction. AM reciprocal lattice, R Ch. 5	
10/03	Diffraction continued. Introduction to tensors: Conductivity. N Ch. 1&2, KGK Ch. 4	PS #5 Due
10/08	Exam review.	
10/10	Midterm Exam.	
10/15	Linear elasticity theory, elastic constants. N Ch. 7&8, KGK Ch. 5	
10/17	Tensors continued.	PS #6 Due
<u>Part II: Bonding and Crystal Binding</u>		
10/22	Intro to bonding. Van der Waal's bonding.	

10/24	Van der Waal's bonding continued, introduction to ionic bonding.	PS #7 Due
10/29	Ionic bonding continued.	
10/31	Ionic bonding: ionicity and electronegativity. R Ch. 7	PS #8 Due
11/05	The need to think quantum mechanically. Introduction to Schrödinger's equation. Particle in a box.	
11/07	Quantum mechanical picture of bonding. Covalent and ionic limits.	PS #9 Due
11/12	Solution to H atom; relationship to periodic table.	
11/14	Covalent bonding. Introduction to the band theory of solids.	PS #10 Due
11/19	AM Bloch, R Ch. 8, KP-Lec.pdf (under lecture notes) Exam on material in Part II.	

Part III: Point and Line Defects

11/21	Point defects and equilibrium. Point defects in ionic materials.	
11/26	Point defects in covalent and metallic materials.	
11/28	Thanksgiving Holiday. No class.	
12/03	Point defects continued. Intro to dislocations.	
12/05	Dislocations continued.	PS #11 Due
12/20	Final Exam 8-11 AM.	

B.O. = Borchardt-Ott

KGK = Kelly, Groves and Kidd

R = Rohrer

S = Sands

N = Nye

AM = Ashcroft and Mermin