MSE 321: Materials Characterization

Course description: Properties of X-rays, scattering and diffraction; crystal structures; X-ray diffraction methods, transmission electron microscopy and scanning electron microscopy.

Number of credits: 3. This course is required.

Course Coordinator: Min Kyu Song

Prerequisites by course: MSE 201

Prerequisites by topic:
1. Atomic structure
2. Bonding
3. Introduction to crystal structures
4. Optics
5. Interference
6. Diffraction

Postrequisites: MSE 323 (or concurrently)

Textbooks/other required materials:
1. P.J. Goodhew, F.J. Humphreys, and R. Beanland, *Electron Microscopy and Analysis:* Taylor and Francis, NY

Course objectives:
1. To provide an introduction to materials characterization and its importance.
2. To discuss different types of characterization techniques and their uses.
3. To review the topic of crystal structure and how structures can be determined using diffraction methods.
4. To describe the properties and behavior of x-rays and their use in materials characterization.
5. To describe the operation and use of a TEM and a SEM.

Topics covered:
1. Introduction to materials characterization methods
2. Crystal structures
3. Crystallography
4. Diffraction
5. Properties and production of X-rays
6. The application of X-ray diffraction in materials science
7. Properties and production of electrons
8. Scanning electron microscopy
9. Transmission electron microscopy

Expected learning outcomes:
1. To be able to explain the production of characteristic x-rays.
2. To be able to explain the principles of diffraction (Bragg's Law) and

its use in crystal structure determination.
3. To explain the properties of electrons and the affect of accelerating potential.
4. To know the basic operational modes of a SEM.
5. To know the basic operational modes of a TEM.
6. To be able to explain the formation of diffraction patterns in the EMs.
7. To understand stereographic projections and their use in characterization of crystalline materials.

Class schedule: Three 50-minute lecture sessions per week, for one semester

Laboratory schedule: None

Contribution to meeting the professional component: Engineering Topics

Relationship of course to student outcomes:
3 strongly supported; 2 supported; 1 minimally supported

Student Outcomes Pre-Fall 2018 (ABET EC2000)

a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
3				3						2	3			2

Student Outcomes Fall 2018 forward (ABET EC2019)

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
3						3		3	3	2

Prepared by: Andrea Butcherite and Dr. Min Kyu Song *Date:* May 30, 2018