Fall 2021 - MatS 4312 – Principles and Applications of Solar Cells

Instructor: Prof. Russell J. Holmes

In this course, we will broadly answer the following questions:

- What are the dominant means of electricity production at the state, national, and international levels?
- What are the primary sources of electricity usage?
- How can a semiconductor pn junction convert sunlight into electricity? What limits the efficiency of this conversion?
- What materials are used for solar cells and how are they processed?
- What are the emerging materials that could be used in the future?

Description: This course begins with a discussion of current energy conversion and consumption before focusing on the working principles and applications of solar cells. Students will understand the operation of solar cells based on optical absorption, carrier generation and recombination, and charge separation in semiconductors. Several different materials platforms for solar cells are discussed including monocrystalline, thin film (inorganic, organic, and perovskite semiconductors), and tandem devices. Students will also develop an understanding of associated cost and economic considerations.

Prerequisites: Upper division, One of Chem 4502, EE 3161, MatS 3013, Phys 2601 or permission from instructor. Ideally, students should be familiar with quantum physics and band theory, though band theory will be reviewed. Students should consider taking this course in their senior year.

Meeting Times: Tu/Th from 9:45-11 AM