

# Laboratory Research Experience

## Laboratory Research Experience Curriculum

### *Week 1: Covalent Chemistry Beyond the Molecule: Introduction to Reticular Chemistry*

- Computational modeling of extended structures
- Solid-state covalent organic framework synthesis
- Powder X-ray diffraction and structure solution
- Surface area and pore size distribution
- Hands-on use of spectroscopy characterization techniques (nuclear magnetic resonance and FT-IR) and thermal gravimetric analysis
- **Distinguished Scholar Seminar: Professor F. Dean Toste**

### *Week 2: Hydrophobic Zeolitic Imidazolate Frameworks for Selective CO<sub>2</sub> Capture*

- Solvothermal synthesis and optical microscopy characterization
- Hands-on use of single crystal X-ray diffraction for structure solution
- CO<sub>2</sub> and N<sub>2</sub> gas adsorption + H<sub>2</sub>O adsorption isotherms
- Heat of adsorption and gas pair selectivity analysis
- Analyzing the selective capture of CO<sub>2</sub> via breakthrough experiments
- **Distinguished Scholar Seminar: Professor Jeffrey Reimer**

### *Week 3: Superacidity in Metal-Organic Frameworks: Applications toward Heterogeneous Catalysis*

- Superacidity and acid-base chemistry
- 'Crystals as Molecules': Post-synthetic modification
- Inert atmosphere synthetic techniques
- Hammett indicator analysis
- Heterogeneous catalysis for petrochemical refining
- Mass spectrometry characterization techniques
- **Distinguished Scholar Seminar: Professor Ting Xu**

### *Week 4: Emerging Inorganic Halide Perovskite Nanostructures*

- Synthesis of all inorganic halide perovskite nanostructures
- Hands-on use of solution-phase synthetic methodology structural techniques, including powder X-ray diffraction and scanning electron microscopy
- 'Bright Light Emitting Nanostructures': Hands-on use of photoluminescence microscopy and UV-Vis absorption spectroscopy
- **Distinguished Scholar Seminar: Professor Kristie Boering**

### *Week 5: Ultrathin Silver Nanowires for High-Performance Transparent Conductors*

- Synthesis of ultrathin silver nanowires
- Hands-on use of powder X-ray diffraction, scanning electron microscopy, transmission electron microscopy, and post-treatment for conductivity enhancement
- 'Nanowires as Transparent Conductors': Fabrication and performance characterization of silver nanowire

transparent conductors

- **Distinguished Scholar Seminar: Professor Kristin Ceder-Persson**

### ***Week 6: Effective Communication, Better Science***

- Keys to success in publishing high impact scientific results
- How to effectively communicate your results via oral and poster presentations
- College of Chemistry graduate student shadowing
- Lawrence Berkeley National Laboratory tour (Advanced Light Source and Molecular Foundry)
- UC Berkeley campus tour
- Poster presentation at the Berkeley Emerging Research Scholar Symposium
- **Distinguished Keynote Seminar: Nobel Laureate Roald Hoffmann**

***Scholars who complete the entirety of the six-week Laboratory Research Experience program will earn a Certificate of Completion from UC Berkeley's College of Chemistry signed by Dean Douglas Clark. Scholars will also earn a letter of recommendation for their graduate school application written by a College of Chemistry faculty member.***