

Dept. of Chemistry and Biochemistry
Organic/Inorganic Seminar Series

Professor AJ Boydston

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Friday, June 29, 2018

2:00 pm Reception, 377 KLA • 2:30 Seminar, 331 KLA



Hosted by Mike Haley

Integrated Synthesis, Design, Additive Manufacturing, and Mechanoresponsive Materials

Abstract: I will discuss two research thrusts from my program: Additive Manufacturing with Mechanoresponsive Materials, and Metal-Free Ring-Opening Metathesis Polymerization. Our research team focuses on the *chemistry* of additive manufacturing with emphasis on:

- 1) incorporation of functional materials, particularly those that respond via conversion of mechanical force into chemical reactivity;
- 2) expansion of the materials space available for AM; and
- 3) selective multi-material printing from “all-in-one” mixed-resin vats.

As representative examples, we will discuss melt-material extrusion of custom mechanochromic filaments, novel formulations that enable inexpensive and efficient access to elastomeric components via vat photopolymerization, and progress toward parallel photo-radical/photo-cationic printing mechanisms for production of graded materials. Our longer-term research objectives center on the ability to integrate mechanoresponsive materials (molecular- to nanoscale), property gradation or heterogeneity (nano- to microscale), and object geometry (micro- to mesoscale) to answer key scientific questions about the interplay between mechanics (and dynamics) of lattice structures and chemo-mechanical coupling. A major *synthetic* effort of my program centers on the development of photoredox-mediated, metal-free methods for polymer synthesis. Recently, we discovered that visible light photoredox catalysis is a viable approach for conducting ring-opening metathesis polymerization (ROMP) of strained cycloalkenes. This divergence from metal-mediated polymerizations introduces a new mechanistic theme for ROMP with unique synthetic outcomes. We will present our fundamental studies on the mechanism of this polymerization and updates on our applications-oriented research toward commercialization.