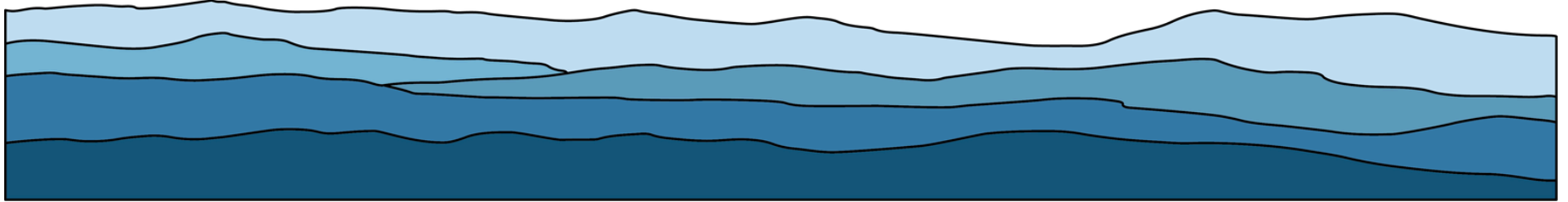


HIGHLANDS IN CHEMISTRY SEMINAR SERIES



Professor Steve Craig

Duke University

“Getting Chemical Reactivity Into and Out of Polymer Networks”

Polymer networks are the basis of materials used in automobile tires, biomedical implants, and building materials. These materials typically form a structural role, in which they bear an external load. That load can be coupled into mechanically responsive functional groups – mechanophores – that are embedded within the polymers. The external force then accelerates and/or biases the outcome of a desired chemical reaction, including reactions that are impossible to achieve through other mechanisms. The talk will begin with examples of this form of mechanochemistry in stoichiometric reactions as well as catalysis, including the fundamentals that underlie it.

January 31, 2025

2:30 PM ET

Hahn Hall North 140

The remainder of the talk will focus on the use reactivity-guided molecular fracture pathways to rewrite traditional performance rules that dictate the limits of polymer network toughness and extensibility. The approach is to embed mechanophores that behave like conventional components of polymer strands and junctions unless and until they are at or near a molecular site of pending fracture. Depending on mechanophore placement and reactivity, polymer networks can be made an order of magnitude easier to an order of magnitude more difficult to tear. Because improvements can be realized without any other measurable change in network properties and require changes to only a few percent of the overall material composition, mechanophores open up possibilities for rapid upgrading of current best-in-class materials with minimal retroengineering.