Materials Science and Engineering Department

Winter Seminar Series

Mechanochemistry of Metallocenes

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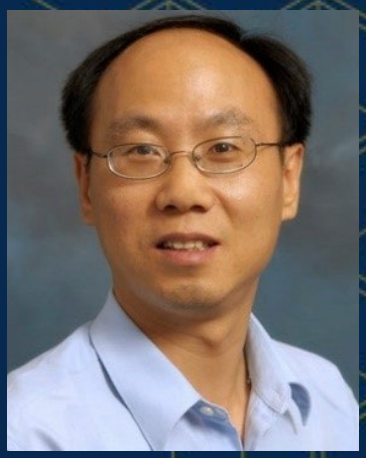

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Polymer mechanochemistry is to trigger transformations within a polymer through the manipulation of force-sensitive functional groups (mechanophores). Mechanophores can be used to produce strain-dependent covalent chemical responses in materials, including stress strengthening, stress sensing and network remodeling. Recent research on the mechanochemistry of metallocene mechanophores has shed light on the force-responsiveness of these thermally and chemically stable organometallic compounds. Controlled polymerizations have enabled the preparation of diverse copolymers with tunable labeling ratios of metallocenes. In this presentation, I will discuss a set of compositions that have been designed to prepare polymers possessing mechanophores of neutral ferrocene and ruthenocene as well as cationic cobaltocenium. Despite the high bond dissociation energy of metal-cyclopentadienyl bond, metallocene mechanophores are found to be selective sites of main chain scission under sonomechanical activation. The capability of mechanochemistry requires substantially different chemical compositions between neutral and cationic metallocenes. The mechanisms of chain scission exhibit distinct behaviors among various metallocenes, as evidenced experimentally and computationally.

Dr. Chuanbing Tang received B.S. from Nanjing University, M.S. and Ph.D. from Carnegie Mellon University with Krzysztof Matyjaszewski and Tomasz Kowalewski, and worked as a postdoctoral scholar at the University of California Santa Barbara with Craig Hawker and the late Edward Kramer. He joined the University of South Carolina Department of Chemistry and Biochemistry in August 2009. Currently he is a University Eminent Professor. His research interests focus on organic polymer synthesis, sustainable polymers, metal-containing polymers, and polymers for biomedical and energy applications. He is a Fellow of American Association for the Advancement of Science (AAAS), American Institute for Medical and Biological Engineering (AIMBE), Royal Society of Chemistry, American Chemical Society Polymer Chemistry Division, and a Kavli Fellow of National Academy of Sciences. He is a recipient of Presidential Early Career Award for Scientists and Engineers (PECASE), South Carolina Governor's Young Scientist Award for Excellence in Scientific Research, National Science Foundation Career Award, ACS Local Section Outreach Volunteer of the Year Award, and UofSC Distinguished Undergraduate Research Mentor Award. He is currently an Editor for Polymer (Elsevier), and serves or served on editors or editorial advisory boards of major polymer journals including Polymer Reviews, Macromolecules, ACS Macro Letters, Macromolecular Rapid Communications, Macromolecular Chemistry and Physics, Acta Polymerica Sinica, Giant, and Green Materials. He has edited one book, published about 160 papers, and received 16 Patents

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