

MSE SEMINAR

February 2, 2018

113 McBryde Hall

3:30 – 4:30 PM

Refreshments at 3:00 PM

Host: Prof. Johan Foster



Professor Martin Thuo

Materials Science & Engineering
Iowa State University, Ames, Iowa

“Non-traditional Synthons for Rapid and Efficient Polymer Synthesis”

Abstract:

Polymers, from DNA, cellulose, to poly-olefins, are ubiquitous to human existence. Potential uses range from the most mundane to being essential in differentiating species. Polymer synthesis, however, has been limited to a set of methodologies with kinetics playing a critical role in the quality of material obtained. We are interested in developing frugal approaches to hydrocarbon and coordination polymer synthesis that challenges the status quo while bringing new opportunities to the materials that can be realized. For hydrocarbon-based polymers, the use of initiator moieties is the first challenge in their synthesis. We are developing the use of free electrons for rapid co-polymerization of so-called ‘armed-disarmed’ monomer pairs. Exploiting solubility and the ability of free electrons to challenge diffusion limited transport, we developed a rapid polymerization method. We extended this approach to synthesis of block co-polymers of complex architecture. In coordination polymer synthesis, however, the main challenge is sustaining steady-state kinetics especially where ‘forced’ precipitation, e.g. in solvothermal synthesis, is used. To mitigate this, we demonstrated that felicitous choice of liquid metal alloy, conjugate acid-base pair, and reaction conditions, allows for auto-regulation of monomer concentration (akin to pH buffers) hence steady-state kinetics. Under these conditions, ‘*ad infinitum*’ polymerization can be sustained, leading to micro-sized polymer chains. Directed *in situ* self-assembly of generated polymer chains leads high aspect ratio shape-tunable nanomaterials. Post-synthesis processing of the product gives high surface area porous semi-conductors with high photo-catalytic selectivity. This talk will highlight the use of free electrons and liquid metals as polymer synthons.

Biography:

Since 2014, Martin Thuo has been an Assistant Professor in the Department of Materials Science and Engineering at Iowa State University. In 2008, he received a Ph.D. from University of Iowa. He was a Mary-Fieser post-doctoral fellow (2009-2011) then a Nanoscale Science & Engineering Center Fellow (2011-2013) at Harvard University under the tutelage of Prof. George M. Whitesides. He is the recipient of a number of awards such as the Lynn-Anderson Research Excellence Award (2008), Akinc Research Excellence Award, Black & Veatch faculty fellowship, among others. His research interests encompass the general theme of frugal innovation, through simplicity, with a focus on soft materials.