

# Fall 2021 Seminar Series

**Martin Thuo**  
Iowa State University

**September 21, 2021**  
1:30 p.m.- 2:30 p.m.

**NCRC B10 Auditorium**



## In, On, and Through the Surface of Liquid Metals

Advances in flexible electronics and wearable electronics demand new low temperature solders while a changing climate calls for new affordable approaches to catalyst design or corrosion protection. Our group couples fundamental surface thermodynamics and autonomous processes to address these challenges. We inferred that low-temperature solders can be obtained by remote melting of a metal and frustrating solidification while corrosion and catalysis can be addressed through surface engineering. This talk explores; i) how complexity in composition of nanoscale (~5 nm) passivating metal oxides can be used to frustrate solidification of metallic particles leading to significant undercooling. Resulting metal particles are used as heat-free solders or formulated to metal inks for printing conductive traces on textured soft

matter like biological tissues, plants, or plastics. Given that solidification occurs upon fracture of the oxide shell, incorporating these particles in a polymer matrix gives self-stiffening material. ii) Where the passivating oxide is used as a reactive surface, organometallic components can be made and either locally deposited or in situ self-assembled through polymerization-induced self-assembly of 1D organometallic polymers. This process being a living polymerization, ad infinitum growth leads to high aspect ratio organometallic nanomaterials. Post-synthesis pyrolysis of the ligands, under low oxygen, leads to carbon-coated metal oxides that show catalytic activity atypical of the parent oxide. In conclusion, we highlight the versatility of nanoscale surfaces/interfaces in materials.

**BIO**

Martin Thuo is an associate professor in the Departments of Materials Science & Engineering and Electrical & Computer Engineering (courtesy) at Iowa State University. Prior to joining ISU, he was a Mary-Fieser (2009-2011) and NSEC (2011-2013) Fellow at Harvard University under George M. Whitesides. He is the recipient of several awards including the ACS Nano Rising Star, Akinc Excellence in Research Award, Lynn-Anderson Research Excellence Award, Black & Veatch Faculty Fellowship, among others. His research interests encompass the general theme of frugal innovation through simplicity.