הטכניון - מכון טכנולוגי לישראל

TECHNION - ISRAEL INSTITUTE OF TECHNOLOGY

הפקולטה להנדסה כימית
ע"ש וולפסון
The Wolfson Department of Chemical Engineering

Wolfson Department of Chemical Engineering Seminar
Wednesday, November 4th, 2020 at 15:00

Online seminar via Zoom
https://technion.zoom.us/j/97591164072

From Biomass Waste to Performance-Advantaged Polymers: Efficient Routes to Lignin Valorization

Prof. Thomas H. Epps, III

University of Delaware, Department of Chemical & Biomolecular Engineering; Department of Materials Science & Engineering; Center for Research in Soft matter & Polymers

Economic challenges continue to hamper the adoption of biobased polymers as alternatives to petroleum-based plastics. Generally, renewable polymers are too expensive due to the inherent variability in biobased feedstocks and the significant separation steps required to make purified monomer streams. Here, we demonstrate that macromolecular materials with reproducible thermal and mechanical characteristics can be synthesized in a controlled and predictable manner from batches of monomers with complex and somewhat variable compositions, such as minimally processed bio-oils obtained from depolymerized lignin. As one example, we leveraged polymer structure-property relationships to fabricate high-performance pressure sensitive adhesives (PSAs) from compounds directly obtained from raw biomass (poplar wood) deconstruction. These PSAs, generated from biobased block copolymers, exhibited the nanoscale characteristics of conventional phase-separated materials and had peel forces and tack forces that were competitive with commercial tapes. As another example, we investigated the thermomechanical and environmental toxicity behavior of newly created bisguaiacol precursors and epoxy networks, for which the precursor compounds could be derived from lignin. These systems demonstrated drop-in potential, in both synthesis and materials properties, relative to petroleum-based analogues, yet most importantly, demonstrated reduced negative environmental impacts when screened by several common toxicity assays. In the above cases we employed raw biomass as our feedstock; however, we have recently demonstrated the versality of our strategy by expanding our feedstocks to other commercial scale inputs and waste streams towards the generation of designer.