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Title: Enabling recyclability in soft elastomers to rigid electronic materials by leveraging dynamic covalent chemistry

Abstract: Dynamic covalent polymers (DCP) are adaptive materials that feature near-equilibrium covalent bonding which can be activated in response to a stimulus. Most of the recent attention on DCPs has concentrated around creating recyclable polymer networks as surrogates for conventional thermosets. Our recent work in this area instead seeks to enhance the utility and expand the functionality of DCPs as illustrated by their development in two drastically different settings. This talk will describe 1) constructing practical elastomers from near-equilibrium polymers with dynamic bonds in their backbone and 2) redesigning a well-known DCP material to enable faster bond-exchange and afford conductive plastics with highly efficient healing behavior.

Bio: Joshua C. Worch joined the Department of Chemistry at Virginia Tech as an Assistant Professor of Polymer Chemistry in December 2022. The Worch Lab focuses on sustainability in polymer science using an integrated approach encompassing polymer synthesis & processing to end-of-life while integrating green chemistry concepts throughout. The group is particularly interested in creating adaptive biopolymers featuring programmable functionality and/or lifetimes by prompting non-equilibrium behaviour. Materials of interest include de-bondable adhesives, semi-synthetic composites from native biomass, sustainable resins for additive manufacturing, and recyclable soft electronic materials. Josh completed his post-graduate training at Carnegie Mellon University synthesizing organic semiconducting materials with Prof. Kevin Noonan. During postdoctoral work that was supported by a Marie Curie Fellowship with Prof. Andrew Dove, he investigated stereocontrolled Click step-growth polymerisations to create biomaterials with tailored thermomechanical properties. Josh then assumed the role of Group Leader in the Dove research group where he initiated research directions on circular bio-resins for 3D printing and photodegradable thermoplastics.