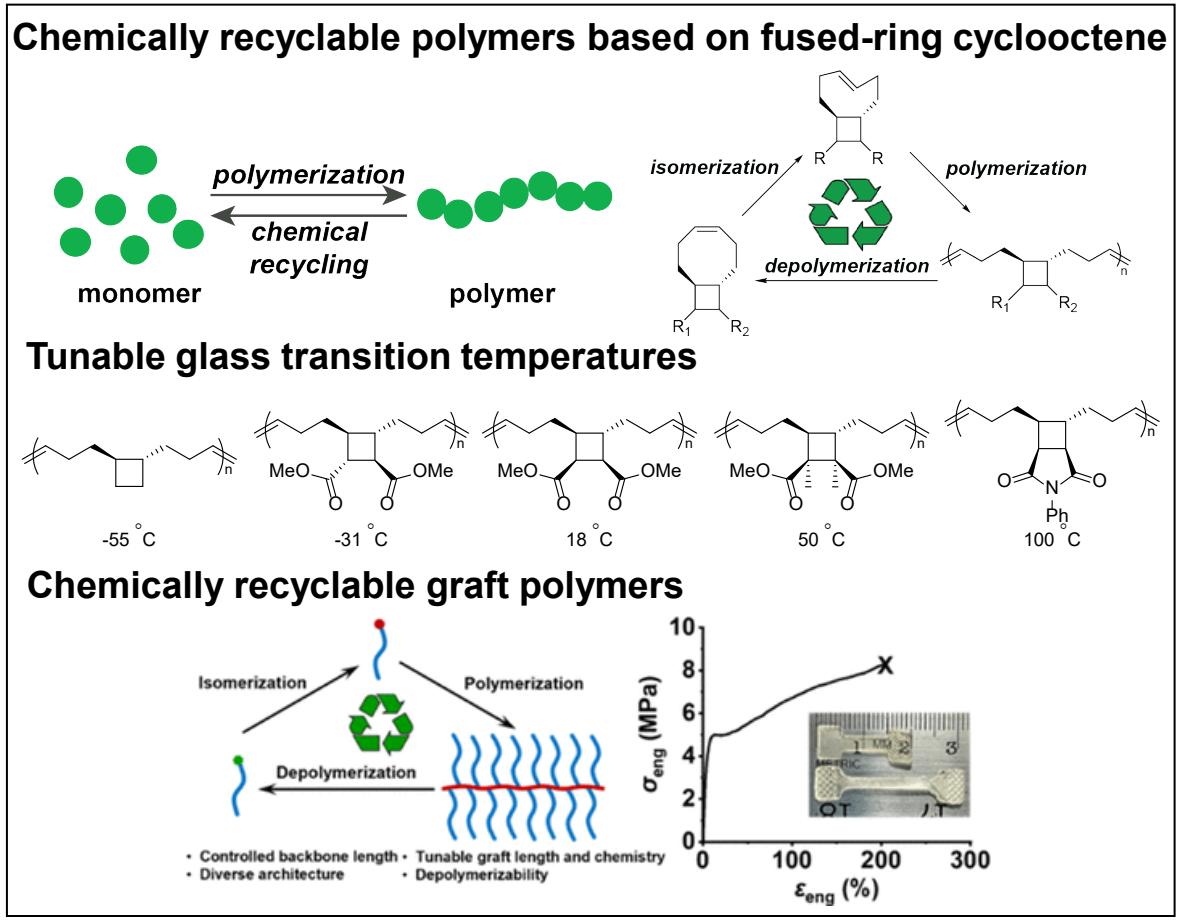
CAREER: CAS: Highly Stable Depolymerizable Polymers with Tunable Thermal and Mechanical Properties as Sustainable Materials

Junpeng Wang, University of Akron

The growing consumption of synthetic polymers along with the accumulation of polymer waste has led to a pressing need for new routes to sustainable polymeric materials. Achieving a closed-loop polymer economy via chemical recycling to monomer is one such promising route. A **new chemically recyclable polymer system** based on ring-opening metathesis polymerization of *trans*-cyclobutane fused cyclooctene monomers has been developed.

Establishing **structure-property relationships** is important for designing next-generation sustainable polymers and for the field of polymer science. Our group have synthesized nineteen fused-ring polyoctenamers and have studied the structural impact on the glass transition temperatures of the polymers.

We demonstrate a robust method to synthesize **depolymerizable graft polymers** by leveraging controlled ring-opening metathesis polymerization of trans-cyclobutane fused trans-cyclooctenes. Low-density ethylene-like material has been made from the graft polymer. The versatile synthesis of depolymerizable graft polymers opens the door to sustainable thermoplastics with diverse material properties.



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In October 2022, our group hosted a **Spooky Science Day** at Akron Children's Museum. Twelve students from my lab participated in the event, and they showcased fun science that are related to our research, including mechanochromic materials, 3D printing, slimy slime, hydrophobic and hydrophilic polymers, gruesome gliders, ultra-scary UV beads, vanishing paper, and spooky shrinky dinks. Over 60 children participated in the activities. Through these activities, children learned about biodegradable polymers, stress-responsive materials, florescent polymers, the difference between hydrophobic and hydrophilic, shape-memory materials, and 3D printing.

We have been organizing a **STEM program** that allows students from **local high schools** to work with faculty in the School of Polymer Science and Polymer Engineering at University of Akron. The students are organized to not only work with faculty mentors on research activities, but also participate in science contests including Akron Science Day and The State of Ohio Science Day.