

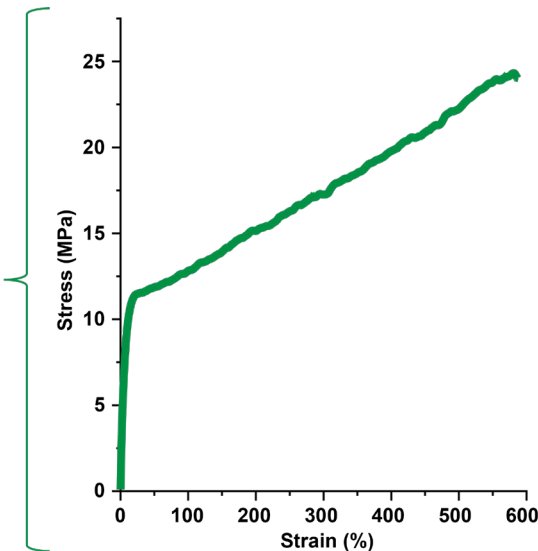
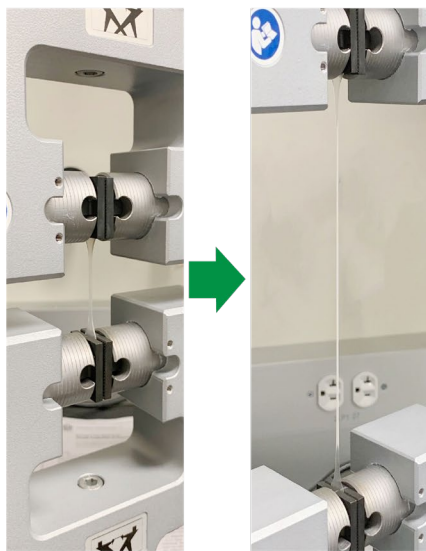
Project Outcome: Researchers supported by this NSF grant have developed a new polymerization catalysis methodology termed “*diastereoselective polymerization*” that can directly polymerize diastereomeric mixtures of same or different monomers at any *racemic/meso* ratio into stereo-sequenced, crystalline polymers with tunable, high-performance thermal and mechanical properties as well as biodegradability.

Caption: Development of the new diastereoselective polymerization catalysis method to convert bio-sourced diolides directly as mixtures of diastereomers into stereo-sequenced, crystalline, high-performance PHAs.

Credit: Eugene Chen

Impact & Benefits: Conventional methods of polymerizing monomers bearing two stereogenic centers into stereoregular polymers requires diastereomer pre-separation/purification into racemic and *meso* isomers, thus accruing significant material loss and additional energy cost. The new diastereoselective polymerization methodology not only avoids material loss and added energy cost, but also utilizes all diastereomers to modulate or enhance materials properties.

Background & Explanation: PHAs are naturally produced by bacteria and biodegradable under ambient conditions. However, current biosynthetic routes are limited by slow kinetics, low volume, and high cost, preventing PHAs as commodity biodegradable plastics. Chemical catalysis approaches provide better scalability, more rapid & facile catalyst tuning to accommodate substrate structures, and faster reaction kinetics. Thus, it is of great fundamental and technological interest to develop an effective chemical catalysis approach to PHAs with properties comparable or better than those by living systems.



Caption: PHAs produced by the chemical catalysis route show excellent mechanical properties as strong, ductile, and tough biodegradable plastics

Credit: Xiaoyan Tang, Eugene Chen