

Primary Applicant	Spero Renewables, LLC
Subrecipients	Argonne National Laboratory (ANL)
Principal Investigators	Ian Klein, Ph.D. (Spero Renewables, LLC) Wu May, Ph.D. (ANL)
Project Title	Recyclable Thermoset Polymers from Lignin Derived Phenols

Recent innovation from the laboratory of Dr. Mahdi Abu-Omar, Mellichamp Professor of Green Chemistry at the University of California Santa Barbara, has resulted in a proprietary technology for producing decomposable and recyclable thermoset polymers. Thermosets are a class of polymers that are irreversibly cured from soft solids or liquid prepolymer, with the aid of heat or other action of energy. Because of the permanent cross-links, thermosets generally possess outstanding mechanical properties, chemical and thermal resistance and excellent insulation. Thermosets are now commonly used as the plastic matrix in performance composites, also known as fiber reinforced plastics (FRPs). Despite the outstanding material properties of FRPs, the non-decomposable and non-recyclable nature of thermosets has limited the widespread applications of thermoset composites. It is estimated that hundreds of millions of dollars are lost each year from the landfilling of thermoset composite wastes.

Spero Renewables' recyclable thermosets incorporate biobased feedstocks including hydroxybenzaldehyde and hydroxymethylfurfural, which can be incorporated at up to 50% of the mass of the polymer. The proposed technology produces thermosets which can be decomposed under mild conditions in aqueous solutions yet possess comparable thermomechanical properties to conventional bisphenol A based thermosets. Spero's thermosets can be chemically recycled, with the thermomechanical properties of recycled thermosets comparable to virgin thermosets.