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Abstract

Vitrimerization: A Novel Concept to Reprocess and Recycle Thermoset Waste via Dynamic Chemistry

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Abstract:

Vitrimerization is a newly developed concept to convert permanent crosslinked thermoset networks into vitrimer type dynamic networks via a simple, one-step method without depolymerization. Vitrimerization relies on designing a strategy to induce re-formability and healing in permanent chemically crosslinked polymer networks by using exchangeable chemical bonds that will lead to dynamic crosslinked networks. Key to the success of the strategy is establishing a process whereby homogeneous catalysts transform waste thermoset polymers into recyclable vitrimers. The vitrimerization approach is a low-cost, eco-friendly and scalable method that can be effectively implemented to address current challenges in recycling thermoset polymers. In this presentation, we demonstrate how vitrimerization can be applied to an epoxy thermoset system. The vitrimerized epoxy displays tunable thermal and mechanical properties at par with the virgin epoxy. Moreover, the recycled thermoset can be used in combination with various nanofillers to manufacture nanocomposites with tailored properties. This simple and practical concept of recycling thermoset polymers without depolymerization provides a new strategy toward elimination of thermoset waste.

Biography:

Dr. Ica Manas-Zloczower is the Thomas W. and Nancy P. Seitz Professor of Advanced Materials and Energy in the Department of Macromolecular Science and Engineering and the Distinguished University Professor at Case Western Reserve University. She received BS and MS degrees in Chemical Engineering from Polytechnic Institute Jassy, Romania and a Doctor of Science in Chemical Engineering from the Technion-Israel Institute of Technology. She was a post-doctoral fellow at the University of Minnesota.

Professor Manas-Zloczower is the recipient of the 2017 SPE Fred E. Schwab Education Award and the 2012 George S. Whitby Award for Distinguished Teaching and Research awarded by American Chemical Society Rubber Division. She was elected and served as the President of the International Polymer Processing Society in 2011-2013. She is also a fellow of the Society of Plastics Engineers and was elected to the Board of Directors of Extrusion Division of the Society of Plastics Engineers in May 2000.

Professor Manas-Zloczower has more than 180 publications in peer-reviewed journals, more than 100 published conference proceedings, and a number of book chapters and patents.

Recent Publications:

1. Ica Manas-Zloczower,et al; Mixing and compounding of polymers: theory and practice,2012
2. Ica Manas-Zloczower,et al; Epoxy composites with carbon nanotubes and graphene nanoplatelets–Dispersion and synergy effects,2014
3. Ica Manas-Zloczower,et al; Effects of branched carbon nanotubes and graphene nanoplatelets on dielectric properties of thermoplastic polyurethane at different temperatures,2019
4. Ica Manas-Zloczower,et al; Characterization of carbon nanotube dispersion and filler network formation in melted polyol for nanocomposite materials,2015
5. Ica Manas-Zloczower,et al; Chemorheology of Poly (high internal phase emulsions),2013
6. Ica Manas-Zloczower,et al; Effect of carbon nanotube dispersion and network formation on thermal conductivity of thermoplastic polyurethane/carbon nanotube nanocomposites,2016
7. Ica Manas-Zloczower,et al; Interface design strategy for the fabrication of highly stretchable strain sensors,2018
8. Ica Manas-Zloczower,et al; Modeling of agglomerate dispersion in single screw extruders,2010
9. Liang Yue,et al;

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