

Polymer Seminar

11:15 am, September 26, 2025

Science 1 - room 1002

Host: Yang Cao

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Dr. Yan Xia

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Stanford University

High Performance Polymer Materials Enabled by Overlooked Chemistry for a Sustainable Future

Abstract: Innovative polymer chemistry plays an important role in achieving a sustainable future. I will present two types of polymers synthesized from commercially available chemicals for energy-efficient gas separations and as recyclable high-performance thermosets. The first type is extremely glassy ladder-shaped polymers from norbornadiene and aryl bromides via an efficient annulation polymerization. These polymers have abundant microporosity, and can be cast into mechanically robust membranes with a remarkable size-sieving effect after an intriguing aging process. These membranes give an unprecedented combination of ultrahigh selectivity and permeability for the separation of industrially important gases with low energy input. The second type of polymers is recyclable thermosets based on polydicyclopentadiene with excellent mechanical strength and toughness. Their recyclability is enabled by an overlooked olefin metathesis reactivity of enol ethers. A small fraction of cyclic enol ether as an additive allowed us to prepare thermosets and composites in an energy efficient frontal process. These materials have convenient processability, tunable thermomechanical properties, can be chemically deconstructed and recycled multiple times while maintaining the processability and material properties.

Bio: Yan Xia received his undergraduate degree in chemistry from Peking University in 2002 and MSc from McMaster University in 2005. He obtained his PhD degree in 2010 from Caltech under the tutelage of Professors Bob Grubbs and Julia Kornfield. Following his PhD, he worked at Dow Chemical as a senior chemist and then a postdoc at MIT. He joined the chemistry department at Stanford University in 2013 and is now an Associate Professor. His research interest is in polymer chemistry and organic materials, tackling a range of fundamental and technological challenges with molecular designs and interdisciplinary approaches. He received Army Research Office Young Investigator Award, 3M Non-Tenured Faculty Award, NSF CAREER Award, Cottrell Scholar Award, Sloan Research Fellowship, and Tosoh Award for Excellence in Polymer Science.