



CENTER FOR CATALYTIC SCIENCE AND TECHNOLOGY SEMINAR



NOV. 20, 2025 | 11:00 AM | 366 CLB

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PLASTIC CIRCULARITY: GRAND CHALLENGES IN CHEMICAL RECYCLING AND A NEW CLASS OF POLYOLEFINS MOLECULARLY DESIGNED FOR CIRCULARITY

The world has cumulatively produced more than 8 billion MT of plastics since 1950 and only 9% of it has ever been recycled¹. This situation is unsustainable. Recycling of plastics faces several complex challenges – availability at scale and heterogeneity of plastic feedstocks, high capital intensity of recycling units and technoeconomic challenges associated with the scale-up². Plastics are recycled using two basic processes – mechanical recycling and chemical recycling. Mechanical recycling is cost-effective but is hampered by the lack of availability of high-quality clean feedstocks and results in a product with inferior properties that can only be used in low-value applications. Chemical recycling involves conversion of mixed plastic waste into pyrolysis oil that can be blended with refinery products such as naphtha and thermally cracked to produce olefins that are polymerized to produce virgin plastics. In the first part of my talk, I will focus on the grand technoeconomic challenges in scaling up chemical recycling of plastics. These technoeconomic challenges are rooted in the complexity of the feedstocks that necessitates multi-step decontamination of the intermediate products and transport limitations that result in high capital intensity. In the second part of my talk, I will describe a novel class of polyesterolefins that demonstrate material properties similar to polyolefins but are molecularly designed for ease of chemical recycling through well-known and scalable chemical routes.