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Chemically Recyclable Polymers Developed by Elaborate Design of Catalysts and Monomers

The development of chemically recyclable polymers is an urgent challenge in the pursuit of a more sustainable future. Although reversible olefin metathesis shows promise for this goal, controlling the reversibility of the process can be challenging due to the thermodynamic preference for one side of the reaction. For example, ring-opening metathesis polymerization (ROMP) of cyclohexenes is difficult due to their low ring strain. Our research group has been working to overcome this challenge by developing highly active catalysts and novel synthetic methods. In this symposium, we will present two strategies we have recently developed.

First, we will discuss our pioneering method for directly polymerizing cyclopentadiene (CPD), a commonly available chemical waste product. Using ruthenium catalysts designed with N-vinyl sulfonamides as carbene precursors, we achieved low-temperature polymerization to produce poly(CPD)s with a unique sequential one-methylene intermediary diene structure.

Secondly, we will introduce a novel class of chemically recyclable polymers made by ROMP of elaborately designed cyclohexene monomers. Our success in achieving polymerization and depolymerization reactions hinged on our ability to control the ring strain of the cyclohexenes. The resulting materials exhibit high hydrolytic stability and oxygen barrier properties, making them excellent alternatives to PVA and EVOH. They can be recycled back into their monomers or repurposed into industrially useful compounds using closed- or open-loop methods.

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Location : 과학관 B131호
Host : 연세대학교 화학과