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Backbone rearrangement of polyesters and polyurethanes

A novel method to modify polyester and polyurethane backbones to change material properties and introduce a handle for degradation.

IP Status: Provisional Patent Application Filed

Applications

- Alter polymer structure and properties
- Introduce a handle for selective degradation

Key Benefits & Differentiators

- **Broadly applicable:** backbones of both polyesters and polyurethanes can be rearranged
- **Access novel structures:** new repeat units, not available via classical polymerization strategies, can be synthesized

Technology Overview

Post-polymerization modifications allow for the fine-tuning and customization of polymer properties to meet specific application requirements. However, the development of post-polymerization modification techniques has largely focused on polymer side chains and end groups, not on the polymer backbone despite the plethora of possibilities it offers. Although methods currently exist to edit polymer backbones, these techniques are highly backbone-specific, which in turn limits their applications.

Researchers at the University of Minnesota have developed a novel method to modify the polymer backbone of both polyesters and polyurethanes. By using a transition metal catalyst, pendant alkenes can undergo a rearrangement and be moved to the polymer backbone. This offers the potential for modification of polymer properties, access to novel repeat units, and introduces a handle for new degradation pathways. The introduction of an alkene into the backbone allows for facile depolymerization via ethenolysis. Rearrangement and subsequent ethenolysis have been successfully demonstrated on the lab scale. This pathway is of value to selectively depolymerize these materials in a mixed plastic waste stream.

Phase of Development

TRL: 3-4
Lab scale proof of concept has been demonstrated.

Desired Partnerships

This technology is now available for:

- License
- Sponsored research
- Co-development

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Technology ID
2023-290

Category
Engineering & Physical Sciences/Chemicals
Engineering & Physical Sciences/Materials

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Researchers

- **Ian Tonks, PhD** Associate Department Head, Lloyd H. Reyerson Professor, Department of Chemistry

References

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