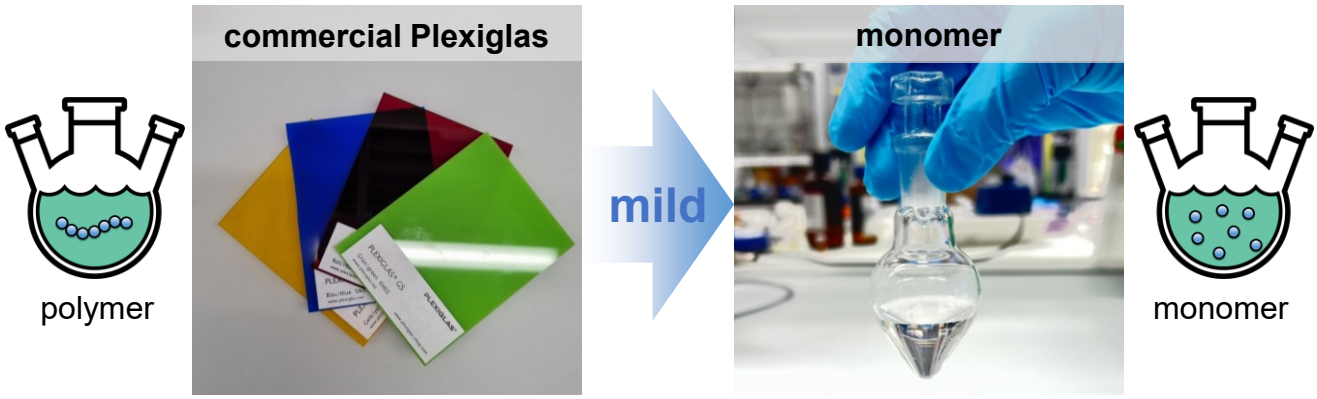
ETH zürich

Licensing Opportunity

Depolymerization of vinyl polymers for the recycling of plastic waste



Chemical recycling (depolymerization) of Plexiglas® to its monomers under mild reaction conditions in high purity and yield.

Application

The photo-activated depolymerization method reverts commercial vinyl polymers like Plexiglas® back into its original monomers. Producers of plastic contribute to the circular economy by implementing this method into their value chain without compromising on quality, purity and yield.

Features & Benefits

- mild reaction conditions
- reusable reagents, energy efficient process
- scalable
- compatible with high molecular weight polymers

Publication

- patent pending

Background

Recycling of plastic waste is a main goal to achieve a sustainable and resource-conserving future. Depolymerizing vinyl polymers is challenging because of their stable all-carbon backbones. Conventional methods rely on very high temperatures (>400 °C) which are energy-intensive and create byproducts. Recent approaches rely on “designer polymers” and cannot be applied to commercial products.

Invention

The presented depolymerization strategy circumvents the aforementioned problems and depolymerizes commercial polymers under mild conditions.

Visible light is used as a trigger to generate radicals on the polymer backbone, leading to concurrent scission and depolymerzation. Conversion of >95% can be achieved for polymethacrylates such as poly(methyl methacrylate) (PMMA), a widely used glass substitute, at temperatures of around 100 °C. Multiple initiation points on a single chain enables the depolymerization of PMMA with very high molecular weights (e.g. 1,000,000 g/mol), or those containing comonomers that do not depolymerize (e.g. acrylates). No special material needs to be synthesized for the chemistry to work and the method is therefore directly applicable to commercial products such as Plexiglas®.

transfer

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Technology Readiness Level