Polyurethane Networks Designed for Fast Depolymerisation

Olga Gotkiewicz[1*], Sébastien Livi[2], Hynek Beneš[1]

[1]*Institute of Macromolecular Chemistry of the Czech Academy of Sciences, Heyrovského nám. 2, Prague 6 162 00, Czech Republic*
[2]*Université de Lyon, CNRS, Université Claude Bernard Lyon 1, INSA Lyon, Université Jean Monnet, UMR 5223, Ingenierie des Matériaux Polymères, CédexF-69621, France*
[*]*gotkiewicz@imc.cas.cz*

Polyurethane (PUR) foams, the most widely produced thermosetting plastics, significantly contribute to the global plastic waste crisis. Conventional disposal methods, such as landfilling and incineration, pose environmental challenges and hinder progress toward a circular economy. A more sustainable approach begins with the design of PUR foams that can facilitate depolymerisation and promote easier chemical recycling.

In this study, we present a novel strategy for enhancing the degradability of PUR foams by incorporating moieties that facilitate cleavage into their structure. The modified foams are based on bio-sourced raw materials and maintain excellent mechanical and thermal properties while enabling more efficient breakdown. Furthermore, the solvolysis of the foams yields a recycled polyol, which can replace up to 50 wt% of virgin polyol in the production of bio-based rigid PUR foams. The resulting materials exhibit stable mechanical performance, a highly closed-cell structure, and enhanced thermal insulation properties, advancing the development of more sustainable PUR-based products.

Keywords: polyurethane, recycling, solvolysis, sustainability

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