INTRODUCING HIGHLY CROSSLINKED PHOTOPOLYMERS WITH DEBONDING ON DEMAND PROPERTIES

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Adhesives and cements, which are used for temporary dental fixations, are commonly based on photocurable resins such as mono- and multifunctional methacrylates. However, the excellent adhesion of those materials to the tooth surface leads to one of their main drawbacks, which is the difficult removal after the temporary fixture is no longer needed.

Therefore, photopolymerizable glues and cements, that offer debonding on demand (DoD) through an external stimulus are of great interest in the field of dental medicine. Through cleavable crosslinks, which are incorporated into the polymer matrix, the mechanical properties of the photopolymer network can be changed by an external stimulus (e.g. light or heat) and lead to DoD. State-of-the-art DoD solutions however often require a high energy impulse (e.g., > 200 °C, strong force), which is due to the typical glassy nature of such photopolymers.

Herein we introduce blocked isocyanates (BICs) that yield thermally induced gas formation at temperatures below 150 °C. The design of a methacrylate-based crosslinker with BIC units and the additional application of a β-allyl sulfone-based chain transfer reagent led to the creation of a thermolabile photopolymer with a tailored network architecture. The resulting material exhibits a sharp glass transition below 100 °C enabling thermally induced gas formation within the highly crosslinked network, thus introducing predetermined breaking points for the realization of DoD.