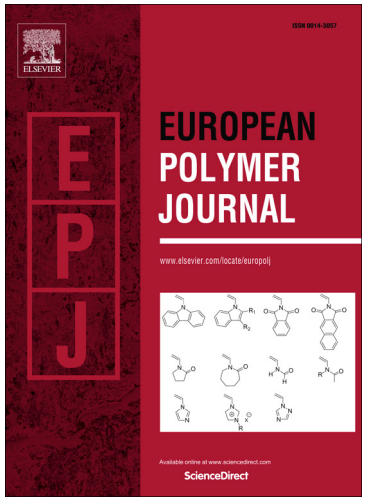

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Sequential curing of amine-acrylate-methacrylate mixtures based on selective aza-Michael addition followed by radical photopolymerization

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ABSTRACT

Dual curing systems find various uses in industry with the process flexibility they provide which allows tailoring properties at different curing stages in accordance with application requirements. A safe and efficient dual curing scheme is proposed here for a set of mixtures containing different proportions of acrylates and methacrylates. The first curing stage is a stoichiometric aza-Michael addition between acrylates and an amine, followed by photo-initiated radical homopolymerization of methacrylates and remaining acrylates. An analysis of aza-Michael reaction kinetics confirmed that amines react selectively with acrylates, leaving methacrylates unreacted after the first curing stage. It was found that acrylate-rich mixtures achieve complete global conversion at the end of the scheme. However, the highest crosslinking density and thermal resistance was observed in a methacrylate-rich formulation. The resulting materials show a wide range of viscoelastic properties at both curing stages that can be tailored to a variety of industrial application needs.

Keywords: acrylate; methacrylate; aza-Michael; dual curing; click reaction; photopolymerization