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Synthesis and properties of PS-PMMA copolymers containing reversible covalent crosslinks as compatibilizers in blends

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Polymer blending is an effective strategy to enhance plastic performance and create new materials without developing entirely new polymers. Compatibilization is essential for producing polymer blends with desirable mechanical properties and for facilitating the recycling of mixed plastic waste.[1] Recent innovations, particularly vitrimers-crosslinked polymers with dynamic covalent bonds-offer promising solutions in this respect.[2] These materials can be reshaped and reprocessed without compromising strength, and recent studies show that blending vitrimers with conventional polymers can significantly improve mechanical and rheological properties, enhancing the performance of degraded plastics.[3-4]

This project explores three strategies to improve compatibility of PS–PMMA blends, chosen as a model system: (1) classical copolymer compatibilization, (2) vitrimer-based systems, and (3) a hybrid approach. The first strategy involves synthesizing PS–PMMA copolymers with random and block architectures using RAFT polymerization. The second strategy introduces vitrimer functionality by incorporating boronic ester groups into PS and PMMA, followed by crosslinking with bis-dioxaborolane. The third, hybrid approach combines copolymers and vitrimers to further enhance interfacial adhesion and mechanical strength. Each method will be evaluated through structural, rheological, and mechanical characterization. The goal is to develop the next generation compatibilizers that support sustainable and efficient plastic recycling.
This poster presents the synthesis of PS–PMMA copolymers with random and block architectures via RAFT polymerization, along with their characterization using NMR and GPC techniques.

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