

Renewable Crosslinker-Based Polypropylene Vitrimers: Synthesis, Characterization, and Properties

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Polypropylene (PP) is one of the most widely used polymers in the automotive sector; however, its application is limited by low UV resistance, brittleness at sub-ambient temperatures, and restricted recyclability. In this context, vitrimers were synthesized from maleic anhydride-grafted polypropylene (PP-g-AM) via reactive extrusion using diglycidyl ether of bisphenol A (DGEBA) and modified cellulose (CM) as crosslinking agents, with Zn(acac)₂ serving as a transesterification catalyst. The resulting materials were systematically characterized through FTIR, TGA, DSC, DMA, XRD, and rheological analyses. Incorporation of CM enhanced thermal stability ($T_{\text{máx}} \approx 449^\circ\text{C}$) and increased crosslinking density (gel fraction up to 50%), while reducing the melt flow index, thereby confirming the formation of dynamic polymer networks. Although CM-based systems exhibited slightly lower crosslinking density than the DGEBA control, they demonstrated comparable performance, with the additional benefit of integrating a renewable resource. These results position PP-CM vitrimers as promising sustainable materials for automotive applications, offering durability, recyclability, and improved mechanical properties.

Keywords: Vitrimers, Reactive Extrusion, Polypropylene

Acknowledgment:

INDELPRO México

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