

SYNTHESIS AND APPLICATION OF FUNCTIONALIZED POLYOLEFINS

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Despite the technological potential and commercial importance of polyolefins[1,2], their apolar character, which reduces the compatibility and adhesion with other materials, limits their application. For example, blends of polyolefins and polar polymers could in principle lead to materials with unprecedented properties that cannot be achieved by either of the independent polymers alone. However, the insufficient interfacial adhesion between polyolefins and virtually any other polymer results in poor mechanical properties of the final products. The adhesion can significantly be improved by the introduction of appropriate interfacial agents. Incorporation of polar functionalities into the polyolefins is believed to enhance the adhesive properties of the polymers and numerous reports describe the synthesis of such products either by reactive extrusion or by catalysis. Yet, little is known about the actual properties of these materials and their potential applications. It is known that block and graft copolymers, applied as compatibilizers, locate preferentially at the interface between the two phases, thereby reducing the interfacial tension [3]. Therefore, amphiphilic block and graft copolymers based on polyolefins and for example polyesters with tunable polarity would be highly desired as compatibilizing agents for a variety of polyolefin-containing blends. The prerequisite is that the different blocks forming the copolymer are identical or at least miscible with the different phases of the blend. Chain-end or randomly functionalized polyolefins form a crucial ingredient for the synthesis of such compatibilizers.

Polyolefin-based block and graft copolymers can be produced using different strategies. The grafting from approach starting from functionalized polyolefins is most commonly reported. Radical, ionic and catalytic ring-opening polymerization are the most prevalent polymerization methods used. The alternative, grafting onto approach is infrequently applied. The combination of second order kinetics and the low concentration of co-reactive groups (typically chain ends and the functionalities at the polyolefins) results in low conversions and long reaction times. Transesterification of a polyester in the presence of a hydroxyl-functionalized polyolefin forms an exception on this rule. Since the concentration of ester functionalities does not change during the reaction, this grafting onto process follows first order kinetics guaranteeing a much high conversion and shorter reaction times than a second order reaction. For this reason and for its simplicity, this method was investigated here as well.

Herein, we describe several approaches to produce functionalized polyolefins and polyolefin-polyester block and graft copolymers where the polyester is polycaprolactone or polypentadecalactone. The efficiency of these block and graft copolymers as compatibilizers in PO-based blends has been studied electron using microscopy techniques while their thermal and mechanical properties were evaluated by DSC and tensile tests.

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