Reactive Compatibilization of Non Functional Immiscible Polymer Blends by Physical Functionalization and Reactive Couplers in Extruders

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ABSTRACT

Polymer blends have attracted great attentions both industrially and academically because of their flexibility and versatility to create new materials with desired properties from existing polymers. Since most of the interesting polymer blends are immiscible, different compatibilization approaches have been proposed. In the plastics industry, reactive compatibilization is widely adopted to compatibilize immiscible polymer blends. Unfortunately, most of the polymers do not contain suitable functional groups for reactive compatibilization. In this study, we aim to provide a relatively simple method to physically functionalize the non functional polymers for reactive blending, instead of the conventional chemically functionalization methods.

Reactive compatibilization of immiscible polymer pairs, containing no suitable functional groups, can be achieved by physically imparting functionality to the

constituent polymers with the addition of commercially available functional polymers, which is miscible with each of the constituent polymers, respectively. In addition, a multifunctional reactive coupler able to simultaneously react with both of the functional groups of the physically functionalized constituent polymers is required, if the two functional groups do not mutually react under the processing conditions. The strategy has been proven to be successful in reactive compatibilization of the immiscible PP/PS, Nylon/PPE and PP/mPPO blends. PP and PS can be physically functionalized by addition of PP-g-MA and SMA copolymers, respectively. On the other hand, PPE and mPPO has very limited functionality, but with the addition of a low molecular weight PPE, possessing 5 times higher phenolic OH contents than high molecular weight PPE, the functionality is significantly increased. The reactive compatibilization of the above physically functionalized polymer pairs can be carried out in an extruder, with the addition of a multifunctional epoxy coupler. The resulting PP/PS, Nylon/PPE and PP/mPPO show finer domain size, better mechanical properties and higher HDT, compared to the uncompatibilized ones.