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Compatibility and Impact Resistance of Biodegradable Polymer Blends Using Clays and Natural Nanotubes YICHEN GUO, XUE YUAN, XIANGHAO ZUO, MIRIAM RAFAILOVICH, Stony Brook University — Montmorillonite clays and Halloysite nanotubes (HNTs) were modified by surface adsorption of resorcinol di (phenyl phosphate) (RDP) oligomers. Biodegradable poly (lactic acid) (PLA) and poly (butylene adipate-co-butylene terephthalate) (PBAT) polymers were blended together with RDP coated clays and tubes. TEM images of thin sections indicated that even though both RDP coated clay nanotubes and platelets located on the interfacial region between two immiscible polymers, only the platelets, having the larger aspect ratio, were able to reduce the PBAT domain sizes. The ability of clay platelets to partially compatibilize the blend was further confirmed by the dynamic mechanical analysis (DMA) which showed that the glass transition temperatures of two polymers tend to shift closer. Izod impact testing demonstrated that the rubbery PBAT phase greatly increased the impact strength of the unfilled blend, but addition of only 5% of clay filler decrease the impact strength by nearly 50% while a small increase was observed with nanotubes at that concentration. A simple model is proposed. The clay platelets are observed to cover the interfacial area. Although they are effective at reducing the interfacial tension, they block the entanglements between two polymer phase and increase the overall brittleness. On the other hand, the HNTs are observed to lie perpendicular to the interface, which makes them less effective in reducing interfacial tension, but far more effective at retarding micro-crack propagation.

Yichen Guo
Stony Brook University

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