

Novel Bioplastic Blends and Nanocomposites

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The now rapidly developing field of plastic materials based on renewable resources provides tremendous opportunities to sustain and enhance the domestic plastics industries, the fourth largest manufacturing sector of the American economy. Growth in the use of these new, greener plastics is proceeding rapidly; however, there are a number of cases in which bioplastics lack the properties needed to compete with increasingly expensive petroleum based materials. Drawing on decades of scientific knowledge about polymer blends, as well as the new emerging field of polymer nanocomposites, these property limitations can be overcome. Renewable cellulosic nanowhiskers (CNW) have been widely investigated in recent years as reinforcement for biopolymers due to their exceptional mechanical properties. The development of novel polymer nanocomposites comprised of CNW incorporated into corn-based polylactide (PLA) is described. A significant increase in the heat distortion temperature is demonstrated for this completely renewable composite material prepared via a novel *in-situ* polymerization approach. Polymer nanocomposites containing carbon nanostructures have been shown to provide numerous advantages over neat polymers in that thermophysical properties can be tailored for targeted applications. Several chemical functionalization routes, including Fischer esterification and surface initiated lactide polymerization, are compared here for their ability to enhance the compatibility of carbon nanospheres and nanotubes with the PLA matrix. Additionally, new chemical routes to novel hybridized reactively compatibilized bioplastic blends will also be described. Bioplastics employed include polylactides (PLA), polyhydroxybutyrate (PHB), and polyamide-11 (Nylon-11).