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Novel durable biocomposites from biobased PC/PLA blend matrix system

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Abstract

High performance polycarbonate (PC) and poly(lactic acid) (PLA) blends were created using compatibilizer and impact modifier with the aid of chain extender. A novel high temperature blending allowed creating the blend having high impact strength and high heat resistance. Atomic Force Microscopy studies have shown that the additive phase concentrated exclusively in brittle PLA phase ensuring high efficiency of impact strength modification with relatively small amount of modifier in composites. Using this high performance PC/PLA blend as a matrix, glass fiber composites were successfully created and characterized. It is found that the small amount of glass fiber loading of bellow 7.5 phr allowed the new PC/PLA blend based composites to maintain excellent elongational properties and good impact strength not observed in most commercial composites. It is found that PLA and PC phases form co-continuous morphology in blend allowing these novel composites reaching high heat resistance of over 133 ºC which further increased to over 145 °C in glass fiber composites. Two matrices based on linear and branched PC were prepared and tested. It is found that glass fiber composites based on branched PC/PLA matrix demonstrate superior mechanical and heat resistance properties over linear PC/PLA matrix composites. A competitive mechanical property, excellent heat resistance (as compared to commercial PC/ABS composites) as well as relatively low density makes novel biocomposites suitable for wide range of structural and durable applications.

Keywords: Glass fibres; Polymer-matrix composites; Injection moulding; Thermoplastic resin; Mechanical properties