

Polymer Reviews

Rheology of poly (lactic acid)-based systems

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Abstract

Being commercialized in 1992, poly (lactic acid) (PLA) has been considered for biomedical applications and as a reliable substitute for a wide range of commodity and engineering applications where noncompostable petroleum-based polymers are currently being used. However, PLA suffers from series of drawbacks and it would not be applicable unless these shortcomings resolve somewhat. Besides the PLA's brittleness and low toughness which originate from its higher glass transition temperature, the major shortcomings which negatively influence the other features of PLA are its low melt strength and slow crystallization kinetics. These weaknesses limit the processability, formability and foamability of PLA, and hence, the manufacturing of PLA based products. In this context, the improvement of rheological and viscoelastic properties of PLA is of a great importance as it enhances the melt strength. To control the PLA's rheological and viscoelastic properties, various attempts such as varying the D-lactide content in PLA molecules, increasing the PLA's molecular weight, the use of chain extender and branching, controlling the PLA's crystallization, compounding with micro-/nano-sized fillers and blending with other polymers have been considered. This article critically reviews these studies that have been conducted so far on rheological investigations of various PLA-based systems.