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PLA-based plasticized nanocomposites: effect of polymer/plasticizer/filler interactions on the time evolution of properties

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Abstract

Poly(lactic acid) nanocomposites containing calcium carbonate nanoparticles and two different low molecular weight plasticizers have been prepared by a two-step melt mixing process. Up to 9 wt% of nanoparticles were successfully added preserving the plasticity of nanocomposites and with beneficial effects on the elastic modulus and yield stress. Mechanical, thermal and transport properties were measured as a function of aging time, up to 20 weeks, to evaluate the phase evolution of the plasticized nanocomposites. An interesting improvement in the time stability of mechanical and transport properties was highlighted and related to the effect of particles/plasticizer interactions on the phase structure.

Keywords: Biocomposites; Particle-reinforcement; Plastic deformation; Physical properties.

Introduction

Poly (lactic acid) (PLA) is probably the most studied among biodegradable polymers, being currently produced from renewable feedstock at an industrial scale and competing in cost with oil based commodities [1]. The interesting mechanical, thermal and optical properties of PLA and PLA based blends and copolymers are suitable for a wide range of applications, from biomedicine to food packaging, and the number of PLA based products on the market is rapidly increasing [1,2]. Pure PLA is inherently stiff and brittle, properties that can be a severe limitation for some applications like flexible food packaging. For this reason, researchers are exploring a number of strategies to balance stiffness and toughness of PLA

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