



Nanocomposites

Original Research Paper

Probing polymer chain constraint and synergistic effects in nylon 6-clay nanocomposites and nylon 6-silica flake sub-micro composites with nanomechanics

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Abstract In this study, we report that a synergistic effect exists in the surface mechanical properties of nylon 6–clay nanocomposites (NC) that can be shown by nanomechanical testing. The hardness, elastic modulus, and nanoindentation creep behavior of nylon 6 and its nanocomposites with different filler loading produced by melt compounding were contrasted to those of model nylon 6 sub-microcomposites (SMC) reinforced by sub-micro-thick silica flakes in which constraint cannot occur due to the difference in filler geometry. Polymer chain constraint was assessed by the analysis of nanoindentation creep data. Time-dependent creep decreased with increasing the filler loading in the NC consistent with the clay platelets exerting a constraint effect on the polymer chains which increases with filler loading. In contrast, there was no evidence of any reduced time-dependent creep for the SMC samples, consistent with a lack of constraint expected due to much lower aspect ratio of the silica flakes.

Keywords Nanomechanics, Creep compliance, Chain constraint, Nanoindentation, Modulus

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