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Effect of nanoparticle aggregation on the creep behavior of polymer nanocomposites

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Abstract. Effects of silica nanoparticle aggregation on the creep behavior of polymer nanocomposites are analyzed. For this purpose, a hierarchical micromechanical model based on the Mori-Tanaka (M-T) scheme is proposed. Formation of interphase region due to the interfacial interaction between the polymer matrix and nanoparticle is incorporated in the modeling. Comparison between the proposed model results considering the viscoelastic interphase shows a good agreement with existing experiment. At the high volume fraction, when the nanoparticles are not well-dispersed into the polymer nanocomposites, it is necessary to consider the viscoelastic interphase together with the nanoparticle aggregation for providing accurate predictions. The results reveal the nanoparticle aggregation affects and degrades the polymer nanocomposite creep resistance. A uniform dispersion of nanoparticles into the matrix leads to a maximum level of the nanocomposite creep resistance. The influences of the nanoparticle volume fraction, diameter and the interphase characteristics on the nanocomposite creep behavior are investigated.

Keywords: Nanoparticle reinforced polymer nanocomposite; Creep response; Aggregation; Micromechanics.

1. Introduction

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