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Numaira Obaid, Mark T. Kortschot, Mohini Sain

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Predicting the Stress Relaxation Behavior of Glass-Fiber Reinforced Polypropylene Composites

Numaira Obaid[a], Mark T. Kortschot[a*], Mohini Sain[b]

[a] Department of Chemical Engineering and Applied Chemistry, Advanced Materials Group, University of Toronto, 200 College Street, Toronto, Ontario, Canada M5S 3E5

[b] Faculty of Forestry, Centre for Biocomposites and Biomaterial Processing, University of Toronto, 33 Willcocks Street, Toronto, Ontario, Canada M5S 3B3

*Corresponding author: mark.kortschot@utoronto.ca, Tel: +1-416-978-8926

Abstract

It is well established that the addition of short elastic fibers slows the relaxation process in composites, but this phenomenon is not well-understood. Our recent study explained changes in the stress relaxation constant by accounting for the time-dependent interfacial shear stress transfer at the fiber-matrix interface. An analytical model was developed and was successfully compared to finite-element experiments. This approach represents a significant departure from the previously published literature, where the effect of fibers on viscoelasticity was typically attributed to changes in the covalent bonds at the fiber-matrix interface. In the present study, the stress relaxation behavior of glass fiber-reinforced polypropylene composites was experimentally measured and compared to analytical model predictions. Further, the effect of additional covalent bonding at the fiber-matrix interface was studied experimentally by introducing an interfacial coupling agent. Good agreement was obtained between the experimental data and the analytical model and it was concluded that most of the stress relaxation behavior of a composite