

The effect of loading rates and particle geometry on compressive properties of polypropylene/zinc oxide nanocomposites: Experimental and numerical prediction

Abstract

Compressive properties, of particulate filled polymer matrix composites, are affected (to a certain extent) by the geometry of the particles, as well as the loading rates. Therefore, this article presents the results on the compressive properties of polypropylene/zinc oxide nanocomposites across strain rates from 10^{-2} to 10^{-3} s^{-1} . The specimens were tested using a Universal Testing Machine for static loading and a conventional Split Hopkinson Pressure Bar apparatus for dynamic loading. Results show that the yield stress and 2.5% flow stress, of both PP/ZnO nanocomposites, showed a positive increment with increasing strain rates. However, the yield strain shows a contradictory pattern, where it decreased with increasing strain rates. PP/ZnO-white seal recorded higher strain rate sensitivity, dissipation energy, stiffness, and strength properties, than that of PP/ZnO-pharmaceutical, over a wide range of strain rates investigated. Interestingly, the Eyring theory almost agreed with the experimental results. Overall, based on the experimental and numerical results, we do believe that particle geometry, as well as strain rates, has a significant influence on the compressive properties of polypropylene/zinc oxide nanocomposites specimens.