

Particle size – Dependent on the static and dynamic compression properties of polypropylene/silica composites

Abstract

The effect of particle size is widely known as an essential factor that influences the mechanical properties of particulate filled polymer composites. However, there is a limited number of works available, on the particular under dynamic perspective. Based on this, the static and dynamic compression properties of polypropylene/silica composites, with particle sizes of 3 μm , 1 μm , 20 nm, and 11 nm, were successfully studied at different levels of strain rates (i.e., 0.01 s^{-1} , 0.1 s^{-1} , 650 s^{-1} , 900 s^{-1} , and 1100 s^{-1}) using a universal testing machine and a split Hopkinson pressure bar apparatus. Results show that the yield strength, the ultimate strength, and the stiffness properties, of polypropylene/silica composites were greatly affected by both particle size and loading rates. Furthermore, particle size also influences the rate sensitivity and the thermal activation volume of polypropylene/silica composites; where, smaller particle recorded lower rate sensitivity. Meanwhile, for the thermal activation volume, the trend was reversed.

Keywords: Polymer–matrix composites, Particle size, Mechanical properties, Mechanical testing, Split Hopkinson pressure bar apparatus