Choong Ming Zhe
Lim Hui Min

DYNAMIC PROPERTIES OF SILICA/NYLON6 NANOCOMPOSITE

Abstract

Addition of nano-particles into the matrix of nylon6 can significantly enhance its material properties. The resultant nylon6 nanocomposites with enhanced properties have potential in defence applications to provide better protection from external impacts. As defence applications involve mainly dynamic loads (e.g. explosions, projectile impacts), this project first experimentally characterized the dynamic properties of nylon6 reinforced by two types of nano-particles, namely Mesoporous Silica Nano-particles (MSN) and Cloisite 93A Nanoclay (93A). The Split-Hopkinson Tensile Bar was used to apply dynamic loads to four materials – pure nylon6, nylon6 with 2wt%MSN, nylon6 with 2wt%93A, and nylon6 with 1wt%MSN and 1wt%93A. Their stress-strain relationships were analyzed. Subsequently, their ultimate tensile strength (UTS), failure strain and energy absorption at failure were compared to ascertain how the reinforcement had altered the properties of nylon6. Nylon6-1wt%MSN-1wt%93A displayed the most superior ductility and energy absorption at failure, and would be recommended for defence usage. However, there was no significant enhancement in the UTS. Furthermore, to determine if nylon6 is suitable for defence usage, ballistic tests on pure nylon6 plates were undertaken using a gas gun to study their resistance to projectile penetration – the ballistic limit (BL) was determined and the failure characteristics analyzed under various impact velocities. The 5mm-thick nylon6 plates had a high BL of 149.7m/s, absorbed greater energy under higher impact velocities and also displayed isotropic property. Thus, nylon6 was found to be suitable for defence usage. Such tests on nylon6 plates could also help set the protocol for future ballistic tests on other materials.