

Abstract

This study focused on the strengthening of aramid polypropylene hybrid composites using both electrospun PAN and CNT doped PAN nanomat. The strengthening of the aramid-polypropylene (PP) composites with both aligned and randomly distributed nanofibres resulted in the improvement of the tensile strength, flexural strength, impact energy absorption and interlaminar shear strength (ILSS). However, compared to the randomly distributed 0.5% PAN nanofibre strengthened aramid-PP composites, the aligned PAN nanofibre strengthened aramid-PP composites had higher mechanical properties with improvements in tensile strength by 6%, flexural strength by 5%, impact energy absorption by 7% and ILSS by 3%. The doping of PAN nanomat with pristine and functionalized CNTs resulted in an improved mechanical properties of the hybrid composites with those strengthened with functionalized CNTs achieving higher mechanical properties. With the increase in CNT concentration in the CNT doped PAN nanomat strengthened hybrid composite the mechanical properties increased. Compared with PAN reinforced aramid-PP composites, the addition of PAN doped with 0.5% functionalized CNTs resulted in an increase in tensile strength by 15%, flexural strength by 35%, impact absorption energy by 26% and ILSS by 32%. It was found that the dominant mechanism of failure for aramid-PP composites without PAN/CNT reinforcement was due to interfacial debonding.

This study shows that the use of aligned electrospun nanofibres help to improve the interlaminar properties of the hybrid composites. Functionalization of CNTs greatly improves the fibre-matrix interaction and thus greatly reducing failure by interfacial debonding. Overall, the doping of aligned PAN nanofibres with functionalized CNTs resulted in improvement in interlaminar and mechanical properties of the hybrid composites.