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EFFECT OF MULTIFILLER REINFORCEMENT ONTO ENERGY ABSORPTION PERFORMANCE OF LIGHTWEIGHT THERMOPLASTIC NANOCOMPOSITES FOR AUTOMOTIVE APPLICATIONS

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Abstract

Modern vehicle structures must be able to withstand severe impact loads at the same time providing safety of the occupants. For the same reasons, structural materials used for crashworthy applications must be characterized by good energy absorption capability. In order to ensure survivability of an accident, structure has to dissipate energy in a controlled manner. This is limited by two factors i.e. induced decelerations and maintenance of a survival space for occupants during a crash.

In case of nano-fillers the stress concentrations are significantly reduced therefore, composite ductility can be maintained at a constant level or even improved, in relation to the neat polymer. Moreover, it has been proved that the addition of nano-sized fillers, rather than micro-sized fillers, can significantly enhance the mechanical properties of the polymeric materials at low filler content. If the filler is in the nano-metric size, an important enhancement can be obtained at content in the range of 0.5-5%, whereas in case of micro-fillers the reinforcing effect is observed at loadings typically higher than 20%.

These unique properties of nanocomposites come from the large number of interfacial effects, existing due to the high surface-area-to-volume ratio of the nano-filler. For spherical nano-particles and nano-fibres this ratio is irreversibly proportional to their radius, and its value can be even up to 1000 m2/g.

This work focuses on the improvement of the mechanical properties of polymer composites reinforced with glass-fibres and nano-fillers, and better understanding of the energy absorption mechanism in these materials. In this study mechanical and morphological properties of PP and PA6 composites filled with different nano and micro materials, were investigated. The effect of matrix and filler material, as well as testing speed, on the mechanical properties of injection moulded composites will be discussed in details.

References

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