Hybridization of PP Composites with Glass and Basalt Woven Fabrics

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Abstract

The fibre hybridization approach in composites is used to improve the impact resistance and the damage tolerance of laminates. Different type of fibre hybridization strategies can be used, namely alternatively stacked, commingled or interpenetrated but usually all are based on the use of two very different fibre type, one having high stiffness and the other having high toughness. Such approach is effective in improving the low velocity impact resistance of the composites but it poses issues related to the different specific properties of fibres (coefficient of thermal expansion, interface compatibility, residual stresses after the laminate production to name a few). Among the reinforcing fibres, glass fibres are very well known for their high performance/cost ratio, and are the most used reinforcing fibres. On the other hand, basalt is considered a serious candidate for replacing glass because of its higher thermal stability, lower environmental footprint and better compressive and impact properties. A new design has been recently proposed for thermoplastic composites based on the gradation of the interlaminar interface strength (IGIS) [1–3]. The interface strength between fibres and matrix is graded through the thickness by alternating woven fibres with compatibilized or not compatibilized polymeric layers. Such approach allowed to combine the static performance of compatibilized fibres with the impact resistance of not-compatibilized ones.

In this work glass and basalt fibres were both used as reinforcing fibres in polypropylene (PP) composites because they possess some very interesting similarities, in terms of physical characteristics (density, molecular formula) and production processing (melting temperatures and shaping technologies). Nevertheless, the superior compressive and impact properties of basalt were used to prepare composites with a better balance between structural performance and cost [4]. The laminates were characterized with static and impact tests. In particular, three point bending was used to evaluate the flexural modulus and strength, while impact properties were evaluated by means of a falling dart impact testing machine. The role of the stacking sequence was investigated and related to the content of glass and basalt fibres.

References

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