INFLUENCE OF THE COMPOSITION ON THE IMPACT DAMAGE RESISTANCE OF THERMOPLASTIC POLYMER COMPOSITES

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Fibre reinforced composites are nowadays state of the art in many different applications, like in aerospace and automotive applications as well as in wind power plants. Such composites typically consist of carbon or glass fibres as well as a thermosetting matrix. An emerging trend is to use thermoplastic polymers as matrix, as these exibit some advantages, like low cycle time, thermoformability, improved joining possibilities and ductility. One until now unresolved question for such thermoplastic composites is the resistance to impact damage and how this can be influenced by specific absorber layers.

Therefore, the aim of this work was to investigate the residual compression properties of glass-fiber reinforced composites by means of compression tests according to ISO 14126 after a specific damage with a ball drop test.

The materials used were thermoplastic composites with polyamide 6 (PA6) or polypropylene (PP) as matrix and glass-fabric linen interlacing with a surface weight of approx. 280 g/m². The plates (350x250 mm²) were produced by layering (film/fabric/film) and pressing in a heating press. From these plates test specimens for the compression test with dimensions 125x10x1,5 mm³ were prepared. The samples were pre-impacted with a ball drop with 0.5 J, 1 J and 2 J and then tested for their residual compression properties and compared with an undamaged reference. In order to improve the shock-absorbing properties, further investigations with modified PP composite plates were carried out. In this case, the PP film between the first and the second glass fabric was exchanged for EVA, LLDPE, MAH-PP and PET.

In conclusion, we found that the compression strength (with and without the absorber layer) is already appreciably reduced as from a pre-damage of 0.5 J. The effectiveness of such absorbing layers can be correlated with their respective mechanical properties. EVA as an absorbing layer generally shows the best property retention values after impact.