Title

CHARACTERISATION OF THE IMPACT BEHAVIOUR OF SHORT GLASS FIBRE REINFORCED POLYPROPYLENE

Abstract text

Short glass fiber reinforced polypropylene (sgf-PP) is becoming of increasing interest for applications in load-bearing, structural components. This is especially the case in the automotive industry with sgf-PP offering high ease of production coupled with cost efficiency. For many of the applications, the impact behavior is of prime importance, usually characterized in standardized Charpy bending impact tests according to EN ISO 179-2. For this purpose the parallel section of the ISO multi-purpose (MP) specimen is used for testing. Typical for this specimen type is a high fiber orientation in the direction of injection, which is also reflected in the impact properties measured. Unfortunately, this specimen type does not allow for characterizing the effects of fiber orientation on impact properties. Hence, a special specimen injection molding tool was developed which allows for the production of specimens with high fiber orientations relative to the specimen length direction (i.e., 0°, 45°, 90°), designated as nearly-unidirectional (UD) multi-tool specimens. This specimen tool was used to produce specimens of sgf-PP with various degrees of fiber/matrix coupling, designated as zero(no)-coupling agent (CA-0; lower bound “reference” material), 100%-coupling agent (CA-100; upper bound material) and 50%-coupling agent (CA-50; medium bound material). To thoroughly investigate the influence of a coupling agent together with orientation effects on impact properties, standard (monotonic) tensile tests and instrumented Charpy bending and tensile impact tests were then conducted using both ISO-MP specimens (thickness 4 mm) and UD specimens (thickness 4 mm).

As expected, the impact strength values were found to be highly orientation dependent, with MP specimens giving highest results in standard Charpy tests. Furthermore, the effect fiber/matrix adhesion and coupling agent content is most significant for 45° oriented samples tested under tensile impact. However, hardly any difference was noticed for the coupling agent contents of 50% and 100%, neither in standard tensile testing of all fiber orientations nor in tensile impact testing of 0° fiber orientation specimens. However, in tensile impact testing of the 45° and 90° samples a clear difference was observed. Hence, this approach could be a valuable tool for material optimization, especially with regard to matrix ductility and adhesion promoters.

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