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Long Fiber Injection Molded Thermoplastic –Fiber Attrition Analysis and Characterization

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Abstract

In fiber reinforced composites, loads are not directly applied to the fibers; rather, loads are applied to the matrix material and transferred to the fibers through fiber ends and the cylindrical surface of the fiber near the ends. When the length of a fiber is much greater than the length over which the transfer of stress takes place, the end effect can be neglected and the fiber may be considered to be continuous. In the case of short-fiber composites, the end effects cannot be neglected and the composite properties are a function of fiber length. In the case of fiber reinforced injection molded composites, understanding the final fiber length and fiber length distribution as a result of processing and equipment parameters is critical to accurately predict the mechanical properties of the final composite.

In this study, glass and carbon long fiber (12-14 mm) polypropylene pellets were molded via an Arburg 350-ton injection mold screw into ISO plaques; parameters such as injection speed and injection screw draft were controlled to determine their effect on fiber attrition. Fiber attrition was determined in the compression, melt, mix, runner, and part using a combination of techniques including sieving, laser particle analysis, and X-ray Computer Tomography. Results indicate greater fiber attrition occurs with conventional screws processing carbon long fiber thermoplastics, while very little variation in fiber attrition occurs with glass fibers. However, it appears that one determining factor of fiber attrition is the gate to the cavity which must be specifically configured for long fiber throughput.

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