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ABSTRACT

Achieving accurate numerical predictions of the orientation of fiber in a shell-core structure is a critical requirement for improving mechanical performance and carrying out structural analysis for long fiber-reinforced thermoplastics (LFRT) in injection molding. When using 3D-mesh computation, the orientation in the shell layer was predicted fairly well, but resulted in over-predictive deviation in relation to the core region. Recently, an objective orientation model, iARD-RPR (improved ARD model and Retarding Principal Rate model), was developed in the rheological field of fiber suspension. We therefore used the iARD-RPR model to enhance the prior fiber orientation predictions in 3D injection molding simulation. For various LFRT composites with the same concentration (40wt%) of glass fiber immersed in two different polymer matrices (polypropylene and polyamide 6,6), the mechanical properties depending on fiber orientation are estimated to a significant degree, and their reinforced performance further compared.

Keywords: Long-glass-fiber-reinforced thermoplastic composites; Shell-core orientation structure; Fiber orientation prediction; Mechanical properties; Injection molding simulation.