607g CFD Study of Flow and Heat Transfer in Miniature Mixers for Nanocomposites
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The Alberta Polymer Asymmetric Mixer (APAM, 2ml) and a mini-batch mixer (MBM, 3ml), which is scaled down from the commercial Haake batch mixer, were built in our lab and used for polymer blends and nanocomposites processing. Previous experimental study has shown that the APAM is effective in mixing polymer blends and nanocomposites. Here we use CFD software, Polyflow from Fluent Inc, to model the transient non-isothermal processing of polystyrene in APAM and in MBM. The flow fields inside MBM and APAM were characterized by velocity profiles, which show the co-existence of shear flow, converging flow and recirculation. The temperature inside both mixers increased due to viscous dissipation. Thermal steady state was reached after 12s and 25s respectively for MBM and APAM. The simulation results were verified by experiment for the MBM by measuring the melt temperature. Finally, the mixing performance of the miniature mixers was characterized using the spatial distribution of shear rate, and shear stress.