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# Three-Dimensional Finite Element Simulation of Polymer Melting in a Single-Screw Extruder

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Tadmor-type models have been extensively used in the literature to determine the melting characteristics of single-screw extruders. Even though Tadmor-type melting models, which are based on Maddock melting mechanism, have been very helpful in elucidating the qualitative trends in melting of polymers in single-screw extruders, the melting process is too complex for a single melting mechanism to be valid for the complete melting section of all extruders for all polymers. Therefore, predictions from Tadmor-type models often have discrepancies with the corresponding experimental data. Instead of using a Tadmor-type melting model, in the present work, melting of an ABS was simulated by a full three-dimensional finite element simulation of the two-phase flow in the compression section of a single-screw extruder. Screw freezing experiments in the single-screw extruder were also conducted for the ABS resin. Numerical simulations as well as experiments exhibit the Maddock melting mechanism. The solid bed width in numerical simulation is found to decrease at a higher rate than that in the experimental data. The possible reasons for the faster melting rate in the simulation are discussed.