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Numerical Simulation of Friction Extrusion Process

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ABSTRACT A three-dimensional computational fluid dynamics model with consideration of both heat transfer and material flow has been developed. The heat generation model from a previous study was adopted. The temperature predictions have a good agreement with experimental measurements, showing that material flow during the friction extrusion process has limited influence on heat transfer. Small solid particles were used as tracked markers in the fluid in the modeling to capture the material flow pattern. The path lines of the particles compare well with experimental observations. The material in the central region is pushed spirally upwards toward the extrusion hole to form the extrusion wire, the near material moves spirally to fill the central region, and that there is a dead zone in the process chamber where the material always stays in the chamber and will not be extruded out.