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Estimation of Stress Levels at the Diverging Exit of a Capillary Die Through the Use of PolyFlow Simulations

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This research has been directed at estimation of wall shear stress at the diverging exit of a capillary die with the help of PolyFlow (Fluent Inc.), a computational fluid dynamics (CFD) simulation software. A linear low-density polyethylene (LLDPE) was extruded at a fixed temperature through various capillary dies having fixed length to diameter (L/D) ratio and fixed exit angles but varying lengths of the conical (or diverging) section. It was found that for a constant volumetric flow rate, as the length of the conical section of the capillary die increased, the onset of shark-skin was delayed. There is a direct dependence of the wall shear stress (or principal stresses), measured at the diverging exit of the die, on the melt strength of the LLDPE. When the principal stresses on the material exceed the melt strength of the material, shark-skin phenomenon occurs. We present comparison of simulated principal stresses at the die exit and the experimentally observed delayed sharkskin phenomenon.