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Non-Isothermal Viscoelastic Flow Simulation of an Annular Extrudate Swell

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Non-isothermal viscoelastic flow simulation of an annular extrudate swell was carried out by the finite element method. The non-isothermal multiple-mode Phan-Thien Tanner model proposed by Sugeng et al., was employed as the constitutive equation. The focus fluid is the HDPE melt with high strain-thickening elongational viscosity characteristics. We calculated the case using two type of Die, converging die (Die A) and diverging die (Die B). And we measured the diameter, thickness and temperature distributions on outer surface of the annular extrudates by use of Die A. The diameter of the annular extrudate in case of Die A is larger than that in case of Die B. The thickness of the annular extrudate in case of Die A is smaller than that in case of Die B. According to the comparison of diameter and thickness of the annular extrudates between calculation result and experimental data, the calculated value of the diameter is larger than that of experimental one, and the calculated value of the thickness is smaller than that of experimental data. The temperature of an annular extrudate makes little influence on the shape of the extrudates. On the contrary, the shape has an influence on temperature distribution of the extrudates. The temperature gradient along the extrudate axis on outer surface of annular extrudate agreed with the experimental data by taking into consideration of air flow around the annular extrudate.