607h Mathematical Modeling of the Co-Rotating Twin Screw Extrusion Process and Experimental Studies

Moinuddin Malik and Dilhan M. Kalyon

The mathematical modeling of the twin screw extrusion process is a challenge associated with the complicated geometry and the necessity to simulate a combination of screw elements in conjunction with the flow behavior of non-Newtonian fluids and under nonisothermal conditions. Here numerical solutions employing 3-D FEM are employed to analyze the coupled flow and heat transfer occurring in the co-rotating fully-intermeshing twin screw extrusion process. Experimental studies employing two well-instrumented twin screw extruders (7.5 mm and 50.8 mm) were conducted to verify the simulation results. Departing significantly from the previous literature FEM meshes were generated to cover combinations of pressure generating and pressure losing elements of the geometry. For example, the flow and heat transfer occurring in reversely configured (left-handed and thus pressure losing) kneading discs were simulated together with the pressure generating fully-flighted and right-handed screw elements. The novel use of combinations of elements in the simulations are shown to offer realistic solutions as demonstrated with the experimental studies.