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Development of Flow Instabilities associated with Micro-Channel Flows of Polymer Melts and Polymeric Suspensions: Experimental and modeling studies D.M. KALYON, Stevens Institute of Technology, H.S. TANG, City College, City University of New York — A mathematical model is proposed to simulate the time-dependent circular micro-channel flow of compressible polymers and polymeric suspensions subject to a pressure-dependent wall slip boundary condition. The model relies on the apparent slip mechanism for the suspensions with the additional caveat of the polymer melt also slipping at the wall according to a pressure-dependent Navier's slip condition. The parameters of pressure-dependent wall slip velocity and shear viscosity material function of the polymer melt are determined using combinations of small-amplitude oscillatory shear, steady torsional and squeeze flows, whereas the parameters of the wall slip and the shear viscosity of the suspensions of the polymer melt are determined using squeeze flow in conjunction with inverse problem solution methodologies. Numerical solutions to the mathematical model suggest that steady flow is generated when the flow boundary condition at the wall is stable, i.e., contiguous weak slip or contiguous strong slip along the entire length of the tube wall. However, under conditions at which the flow boundary condition changes from weak to strong slip at any location along the length of the die wall, time-dependent variations in pressure and mean velocity are observed.

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