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Entrance Pressure Fluctuation of LLDPE in Capillary Flow[1]
HAIQING HU, SHUAI LI, LUYAO YAN, TONGJIE SUN, LINLIN LIU, Ministry of Education/Shandong Provincial Key Laboratory of Rubber-plastics; Qingdao University of Science and Technology, HE CHENG, Dongguan Institute of Neutron Physics, China; China Spallation Neutron Source, Institute of High Energy Phyisics CAS, Dongguan — Oscillating flow, which usually refers to the whole capillary pressure oscillation under constant piston speed, has been widely studied as an important instability phenomenon in capillary flow. The coil-stretch transition of entangled polymer molecules can be considered as a critical factor resulting in oscillating flow, which is only observed under controlled piston speed. It has been theorized by Weill since 1980 that the appearance of surface distortions may originate from a high-frequency oscillatory flow created at the die entry, but no experimental evidence has been found to prove it over 30 years. Wall slippage plays an important role in capillary extrusion flow instability for LLDPE melt. Local stick-slip transition leads to perturbations on the exit stress and sharkskin distortion, while global stick-slip transition results in oscillatory flow and the second glossy region or quasi periodic variation of extrudates. This article has revealed the correspondence relationship between entrance pressure fluctuation and exit stress perturbation experimentally and illuminated it by Uhland model. We have further confirmed the idea that local wall stick-slip transition can induce the entrance pressure fluctuation. In brief, the molecular disentanglement in die exit determines the critical shear stress of entrance pressure fluctuation.

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