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Identification of viscous droplets' physical properties that determine droplet behaviors in inertial microfluidics SOOJUNG CLAIRE HUR, Rowland Institute at Harvard University — Inertial effects in microfluidic systems have recently recognized as a robust and passive way of focusing and ordering microscale particles and cells continuously. Moreover, theoretical analysis has shown that there exists a force away from channel walls in Poiseuille flow that locates deformable particles closer to the channel center than rigid counterparts. Then, the particle deformability can be extrapolated from the positions of particles with known sizes in the channel. Here, behaviors of various viscous droplets in inertial flow were investigated to identify critical properties determining their dynamic lateral position. Fluorinated oil solutions (μ =1.7mPas and 5mPas) containing droplets (1mPas<μ<1.3Pas) were injected into a microfluidic channel with a syringe pump (8<R_c<50). Interfacial tension between aqueous and oil phases were varied by adding controlled amount of a surfactant. The diameter, a, deformability, Def, and dynamic lateral position, X_{eq}, were determined using high-speed microscopy. X_{eq}, was found to correlate with the particle Capillary Number, Ca_P, regardless of droplet viscosities when Ca_P <0.02 or Ca_P >0.2, suggesting that the viscous drag from the continuous phase and the interfacial tension were competing factors determining X_{eq}. Experimental results suggested that (i) interplay among droplet's viscosity, interfacial tension and inertia of carrier fluid determines dynamic lateral position of droplets and (ii) the dominant property varies at a different regime.

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