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Repulsive and Attractive Colloidal Particle-Wall Interactions in Poiseuille and Electroosmotic Flow through Microchannels[1] MINAMI YODA, NECMETTIN CEVHERI, Georgia Institute of Technology — Manipulating near-wall polystyrene particles in a dilute suspension flowing through a microchannel is important in microfluidics. Such particles experience wall-normal lift forces in electroosmotic (EO) flows driven by electric fields of magnitude E, and in Poiseuille flows driven by pressure gradients $\Delta p/L$ beyond the forces predicted by DLVO theory. Recent evanescent-wave particle tracking studies of combined EO and Poiseuille flow have shown that 245 nm radii particles are repelled from, or attracted to, a fused-silica wall when the EO flow is in the same, or opposite, direction as the Poiseiulle flow, respectively. Estimates of the lift force magnitude $\mathcal{F}$ suggest that it scales with the shear rate $\dot{\gamma}$ for Poiseuille flow, and not the $\dot{\gamma}^2$ typical of electroviscous lift. Surprisingly, when the force is repulsive, $\mathcal{F}$ exceeds the sum of the forces observed for EO flow at the same E and Poiseuille flow at the same $\Delta p/L$ and appears to scale as $\dot{\gamma}^{1/2}$. Furthermore, in both cases $\mathcal{F}$ appears to be proportional to E, suggesting that this lift force is distinct from those observed in "pure" EO and "pure" Poiseuille flows.

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