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Colloidal particle dynamics during the steady-state bands stage[1]
MINAMI YODA, ANDREW YEE, Georgia Inst. of Tech. — Polystyrene particles in a very dilute (volume fractions = $O(10^{-5}$–$10^{-3})$) suspension become concentrated near the wall, then assemble into streamwise structures called "bands" which only exist within a few μm of the wall, when subject to pressure and voltage gradients in the same direction. These bands, which attain steady-state within $O(10^2$ s), have cross-sectional dimensions of a few μm, *vs.* a channel depth $H = 34$ μm, and a length comparable to that of the channel of a few cm. Tracer particles were used to track the dynamics of $a \approx 250$ nm radius particles within and between the bands in this steady-state stage at different streamwise locations. The time scales of band formation appear to scale linearly with streamwise position past an "entrance length" region. The particles within the bands "lag" the flow, as do the much fewer particles between the bands, though their velocities are closer to the expected flow velocities. The time scales for achieving steady-state bands are compared with the time scales of near-wall particle concentration. Results over different wall-normal extents suggest that the particle concentration within the bands may be underestimated in these evanescent-wave visualizations because they visualize the "edge" of the bands.

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