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Kinetic theory for cross-stream migration in dilute solutions of rigid polymers and Brownian fibers undergoing rectilinear flow near a wall[1] JOONTAEK PARK, JONATHAN BRICKER, JASON BUTLER, Chemical Engineering, University of Florida, CHEMICAL ENGINEERING, UNIVERSITY OF FLORIDA TEAM — We present a kinetic theory for the migration of a dilute solution of rigid polymers and Brownian fibers undergoing rectilinear flows and include hydrodynamic interactions with the bounding walls. The results clarify the origin and direction of the migration observed in experiments and recent simulations. We show results for a rigid polymer undergoing simple shear flow near a single wall and pressure-driven flow between two bounding walls. In simple shear flow, rigid polymers migrate away from the wall due to hydrodynamic interactions with the wall, creating a depletion layer in the vicinity of the wall which thickens as the flow strength increases relative to the Brownian force. In pressure-driven flow, an off-center maximum in the center-of-mass distribution occurs due to a competition between hydrodynamic interactions with the wall and the anisotropic diffusivity induced by the inhomogeneous flow field.

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