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Magnetically Guided Propulsion of Osmotic Motors GLENN VIDAL, CARLOS RINALDI, UBALDO CÓRDOVA-FIGUEROA — Propulsion of artificial nano- and micro-scale objects induced by chemical reactions is one of the most exciting challenges in colloidal physics. Recent experiments have shown that directed motion of catalytic motors is hindered by their rotary Brownian motion, preventing its potential to be fully realized. The present work investigates the magnetically guided propulsion of a colloidal particle–the osmotic motor– immersed in a dispersion of colloidal 'bath′ particles subject to an unidirectional magnetic field using Brownian dynamics simulation. The osmotic motor is propelled by a chemical reaction that consumes bath particles over a portion of its surface. The non-equilibrium microstructure of bath particles induced by the surface reaction creates an 'osmotic pressure′ imbalance on the motor′s surface causing it to move to regions of lower bath particle concentration. The strength of the magnetic field is controlled by the Langevin parameter, which physically measures the relative importance of magnetic to Brownian torques, and dictates the directionality of the osmotic motor. The translational self-diffusivity is measured for different reaction speeds, particle sizes, bath particle concentrations, and magnetic dipole orientations. Finally, a theory to determine the long-time self-diffusivity and time-averaged particle velocity is developed and compared to the simulation results.

Glenn Vidal

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