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Concentration Gradients in Mixed Magnetic and Nonmagnetic Colloidal Suspensions RANDALL ERB, BENJAMIN YELLEN, Duke University — The ability to form concentration gradients in mixed magnetic/nonmagnetic colloidal suspensions using magnetic field gradients has many practical applications in the fields of biosensors and life science diagnostics. Previously, we developed and experimentally confirmed a self-consistent model describing the local distribution of magnetic nanoparticles exposed to a magnetic field gradient. Here, we have derived an analytic expression to describe the local concentration of nonmagnetic colloids which are also affected by field gradients when inside magnetic colloidal suspensions. The model calculates the force on particles as a function of local magnetic particle concentration, and solves for the equilibrium distribution of particles through the drift-diffusion equations. We investigate the ability to concentrate and deplete nonmagnetic particles from specific regions of a substrate, such as nearby patterned micro-magnets on a substrate. Also, we have qualitative experimental results to support our expression. Our results show that nonmagnetic particles which are 5-10 times larger than the magnetic nanoparticles can be effectively concentrated or depleted at specified regions of the substrate.

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