1. Magnetophoresis of Nonspherical Microparticles in a Uniform Magnetic Field
2. Dynamics of Ellipsoidal Particles in Simple Shear Flows under the Influence of Uniform Magnetic Fields
3. Numerical Investigation of Force-Free Magnetophoresis of Nonspherical Microparticles

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Numerical Investigation of Force-Free Magnetophoresis of Nonspherical Microparticles JIE ZHANG, CHENG WANG, Missouri University of Science and Technology — Our group recently demonstrated novel force-free magnetophoresis to separate nonspherical particles by shape. In this approach, a uniform magnetic field is used to generate a magnetic torque, which breaks the rotational symmetry of the particles and leads to shape-dependent lateral migration of the particles. We use direct numerical simulations to gain a better understanding of this magnetophoresis mechanism by focusing on ellipsoidal microparticles - a representative type of nonspherical particles encountered in biomedical engineering. We study key effects that influence the rotational and translational behaviors, including particle-wall separation distance, direction and strength of the magnetic field, particle aspect ratio and size. The numerical results show that the lateral migration is negligible in the absence of the magnetic field. When the magnetic field is applied, the particles migrate laterally. The migration direction depends on the direction of external magnetic fields, which controls the symmetry property of the particle rotation. These findings agree well with experiments. Our numerical simulations yield a comprehensive understanding of particle migration mechanism, and provide useful guidelines on design of separating devices for non-spherical micro-particles.

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