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Controlling ferrofluid droplets motion using surface tension gradients and magnetic fields MOHAN PANTH, Miami University, KHALID F. EID, ANDREW SOMMERES, ODY TAYLOR, Miami University of Ohio — Ferrofluids are suspensions of magnetic nanoparticles in carrier liquid and they exhibit interesting properties. With the application of external magnetic field, we can control the properties and flow of these liquids significantly. Ferrofluids have many potential biomedical and technological applications and are already used in sealing hard disc drives, x-ray tubes, controlling heat in loudspeakers. In our study, we prepare a hydrophobic copper surface with hydrophilic, wedge-shaped aluminum-covered areas. The surface tension gradients created on these surfaces facilitate the spontaneous motion of the ferrofluid droplets towards the more hydrophilic Al parts, due to a net capillary force exerted by the surface tension gradients. We observed that applying a magnetic field parallel to the surface tension gradient direction has little effect on the motion, while a strong perpendicular magnetic field can stop the motion. We observe a pinning of drops in perpendicular magnetic field of 250 Gauss (G) but there is motion in parallel fields up to 1500 G. We measure the maximum velocity when a ferrofluid droplet is placed on those wedges and the average velocity along the whole wedge. The contact angle at different magnetic fields (0, 500, 1000, and 1500 G) is also studied on both hydrophobic and hydrophilic surfaces. In perpendicular magnetic field, the field lines created by the electromagnet create nanoparticle chains that oppose the motion of the ferrofluid resulting in high viscosity and in parallel the field lines align with the direction of motion of ferrofluid and thus facilitate the motion by decreasing the viscosity.

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