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Tunable Magnetic Forces for Trajectory Modification of Gliding Microtubules G.B. VIEIRA, K.D. MAHAJAN, G. RUAN, C.J. DORCENA, G. NABAR, The Ohio State University, N.F. BOUXSEIN, Sandia National Laboratory, J.J. CHALMERS, The Ohio State University, G.D. BACHAND, Sandia National Laboratory, R. SOORYAKUMAR, J.O. WINTER, The Ohio State University —
Carefully engineering patterned magnetic structures provides the ability to apply directed, tunable forces to nanoscale fluid-borne objects due to the presence of localized magnetic field gradients. Here we apply this technique to investigate dynamic control of the motion of the ATP-driven microtubules (MTs) gliding on a kinesin-coated surface. The MTs are combined with magnetic nanoparticles and quantum dots to facilitate application of forces and fluorescent tracking. We observe that MTs can be deflected or trapped by the magnetic structures while the ATP-driven motion persists. This manipulation technology may be ideal for biological systems and biomedical applications because directional changes in motor-based transport are induced non-invasively, and the technique can be scaled up to apply forces at many locations simultaneously on the same device.

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