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Fabrication of Magnetically Actuated Polymeric Nanorod Arrays to Mimic Biological Cilia[1] A.R. SHIELDS, B.A. EVANS, University of North Carolina at Chapel Hill - Physics Department, R.L. CARROLL, University of West Virginia - Chemistry Dept., R. SUPERFINE, University of North Carolina at Chapel Hill - Physics Department — We report on successful fabrication of free-standing polymer nanorod arrays capable of actuation via externally applied magnetic fields. Our primary motivation is to mimic the ability of epithelial lung cilia to promote microscale fluid transport. Additionally, nanoscale actuator arrays of this nature have a wide variety of possible applications including microfluidics, sensing, and photonics. To fabricate these structures we utilize porous polycarbonate track-etched membranes as templates for a dispersion of a magnetic nanoparticle ferrofluid in polydimethylsiloxane (PDMS). Crosslinking of the polymer followed by subsequent dissolution of the membrane releases the rod array. With this method we have successfully fabricated rods with diameters down to 200 nanometers and lengths of 10-25 microns. Rods of various sizes have been successfully actuated with permanent magnets as well as an integrated magnetic force microscope that was developed in-house. We have demonstrated that actuation induces local fluid flow and are currently developing increased control over the array's actuation pattern to more closely resemble that of biological cilia.

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