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Directed Fluid Flow Produced by Arrays of Magnetically Actuated Core-Shell Biomimetic Cilia B. L. FISER, A. R. SHIELDS, Department of Physics and Astronomy, University of North Carolina at Chapel Hill, B. A. EVANS, Department of Physics, Elon University, R. SUPERFINE, Department of Physics and Astronomy, University of North Carolina at Chapel Hill — We have developed a novel core-shell microstructure that we use to fabricate arrays of flexible, magnetically actuated biomimetic cilia. Our biomimetic cilia mimic the size and beat shape of biological cilia in order to replicate the transport of fluid driven by cilia in many biological systems including the determination of left-right asymmetry in the vertebrate embryonic nodal plate and mucociliary clearance in the lung. Our core-shell structures consist of a flexible poly(dimethylsiloxane) (PDMS) core surrounded by a shell of nickel approximately forty nanometers thick; by using a core-shell structure, we can tune the mechanical and magnetic properties independently. We present the fabrication process and the long-range transport that occurs above the beating biomimetic cilia tips and will report on progress toward biomimetic cilia induced flow in viscoelastic fluids similar to mucus in the human airway. These flows may have applications in photonics and microfluidics, and our structures may be further useful as sensors or actuators in microelectromechanical systems.

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