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Fabrication Challenges in Producing Magnet-tipped Cantilevers for Magnetic Resonance Force Microscopy STEVEN A. HICKMAN, Dept of Chemistry, SEAN R. GARNER, Dept of Physics Cornell University, LEE E. HARRELL, Dept of Physics USMA, JEREMY C. ONG, SEPPE KUEHN, JOHN A. MAROHN, Dept of Chemistry Cornell University — Magnetic resonance force microscopy (MRFM) is a technique that may allow MR imaging of single molecules – an extremely exciting prospect. To date we have demonstrated MRFM sensitivity of $\sim 10^5$ proton spins. By making improved magnetic tips and increasing force sensitivity, it may be possible to achieve single-proton sensitivity necessary for molecular imaging. In MRFM the force exerted on the cantilever, per spin, is proportional to the field gradient from the cantilever's magnetic tip. Achieving single proton sensitivity thus requires dramatically reducing magnet size. We have developed an e-beam lithography process for batch fabricating nanoscale magnets on silicon cantilevers. With these sized magnets we will still require attonewton force sensitivity. Research by our group has shown that surface induced dissipation is a major noise source. We believe this can be minimized by producing magnets overhanging the cantilever end. As proof of concept, we will show a 50-nm overhanging cobalt magnet made by a process involving KOH etching, as well as preliminary work on making overhanging magnets by dry fabrication methods. Our current challenge appears to be preventing the formation of metal silicides.

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