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Fabrication Of Nickel-tipped Cantilevers for Magnetic Resonance Force Microscopy STEVEN HICKMAN, E.W. MOORE, S. LEE, S.R. GARNER, J.C. ONG, S. KUEHN, J.A. MAROHN, Dept of Chemistry, Cornell University — Magnetic resonance force microscopy (MRFM) is a technique that may one day allow us to acquire magnetic resonance images of single molecules. To date we have demonstrated that MRFM can achieve a sensitivity of $\sim 10^5$ proton spins, using a custom-fabricated silicon cantilever with a 9 micron diameter magnet tip. By making improved magnetic tips and mitigating surface dissipation, it may be possible to achieve single-proton sensitivity. Achieving the attonewton force sensitivity necessary to image single proton spins requires custom-fabricating cantilevers with extreme dimensions. 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 therefore also requires dramatically reducing magnet size. We have developed an electron-beam-lithography(EBL) process for batch fabricating nanoscale tip magnets on ultrasensitive silicon cantilevers. Research by our group has shown that surface induced dissipation is a major source of noise, which can be minimized by fabricating the magnets overhanging the end of the cantilever. We will present 50-600 nm wide nickel overhanging magnets fabricated by EBL and isotropic plasma etching. With our designed cantilever, we expect a sensitivity of better than 10^3 protons.

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