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High-Resolution Magnetic Resonance Force Microscopy using Iron Filled Carbon Nanotubes MICHAEL HERMAN, PALASH BANERJEE, KIN CHUNG FONG, DENIS PELEKHOV, The Ohio State University, FRANZISKA WOLNY, THOMAS MUHL, BERND BÜCHNER, Leibniz Institute for Solid State and Materials Research, CHRIS HAMMEL, The Ohio State University — Magnetic Resonance Force Microscopy is able to probe below surfaces to map out spins in a non-destructive manner by measuring the force from the dipolar coupling of a magnetic probe to spins in the sample. We have used low force constant cantilevers with low intrinsic dissipation to obtain 2 spin sensitivity. To obtain better sensitivity one avenue of improvement is to increase the magnetic field gradient from the magnetic probe. Iron-filled carbon nanotubes provide a promising route for very high magnetic field gradient micromagnetic probes; we have successfully attached these iron nanowires to IBM style ultrasoft silicon cantilevers. The smaller size of the tip (15 to 25 nm) allows gradients an order of magnitude greater than micron-sized rare-earth magnets. In addition, iron filled carbon nanotubes have the possibility to lower the non-contact friction by reducing the surface area of the probe close to the sample. Iron filled carbon nanotubes also exhibit high anisotropy fields, a result of the shape anisotropy. This work was supported by The Army Research Office under W911NF-07-1-0305 and the National Science Foundation under DMR-0807093.

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