

**Session G14 - Focus Session: MEMS/NEMS Science,
Technology, Applications and Measurements I.**
FOCUS session, Tuesday morning, March 04
Room 8C, Austin Convention Center

**[G14.011] Development of Ultra-Sensitive Cantilever
Magnetometers with Integrated Samples**

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Cantilever magnetometry is a promising method for studying individual ferromagnetic samples with high sensitivity. A sample is placed onto a cantilever, and an external magnetic field H_0 is applied in the cantilever plane. A small torque field H_T is applied perpendicularly to the cantilever plane and oscillated at the cantilever resonance frequency. This results in an oscillating torque that drives the cantilever. The amplitude is detected, H_0 is swept, and a quantitative M-H curve is obtained. The sensitivity of this method is limited by the cantilever thermal noise, and ultra-sensitive cantilevers have been fabricated to increase sensitivity. Film patterning and deposition have been integrated with cantilever fabrication. Current demonstrated magnetic moment sensitivity is $6.7 \times 10^{-15} \text{ Am}^2$ ($\sim 10^9 \mu_B$) at 300 K. This method has added reliability and increased information if the frequency shift due to magnetic stiffening as a function of H_0 is also measured. This technique yields two independent values for the saturation magnetization M_S , a quantitative M-H curve, and anisotropy information. Values of M_S are within 3% of the expected value, indicating this is a reliable method for measuring magnetic reversal in small ferromagnetic samples.