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Scanning Hall Probe Microscopy (SHPM) using Quartz Crystal AFM Feedback MUNIR DEDE, KORAY URKMEN, AHMET ORAL, Bilkent, IAN FARRER, DAVID RITCHIE, Cambridge — Scanning Hall Probe Microscopy (SHPM)[1] is a quantitative and non-invasive technique for imaging localized surface magnetic field fluctuations such as ferromagnetic domains with high spatial and magnetic field resolution of $\sim$50nm & 7mG/Hz$^{-1/2}$ at room temperature. In the SHPM technique, Scanning Tunneling Microscope(STM)[1] or Atomic Force Microscope(AFM)[2] feedback is usually used for bringing the Hall sensor into close proximity of the sample. In the latter, the Hall probe has to be integrated with an AFM cantilever in a complicated microfabrication process. In this work, we have eliminated the difficult cantilever-Hall probe integration process; a Hall sensor is simply glued at the end of 32,768Hz Quartz tuning fork, as force sensor. The sensor assembly is set to oscillate with a PLL. SHPM electronics is modified to detect AFM topography and the frequency shift, along with the magnetic field image. The resonant frequency of the sensor drops to $\sim$5 kHz due to mass of the Hall sensor. Hard Disk, NdFeB Magnet, Garnet samples are imaged with the Quartz Crystal AFM feedback and the performance is found to be comparable with the SHPM using STM feedback. Quartz Crystal AFM feedback offers a very simple sensor fabrication and operation in SHPM. This method eliminates the necessity of conducting samples for SHPM. [1] A. Oral *et. al.* Appl. Phys. Lett., 69, 1324 (1996) [2] A.J. Brook *et. al.* Appl. Phys. Lett. 82, 3538 (2003)

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