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Conductive atomic force microscopy measurements of nanopillar magnetic tunnel junctions E. R. EVARTS, C. HOGG, Physics Dept, Carnegie Mellon University, J. A. BAIN, Electrical and Comp. Eng. Dept, Carnegie Mellon University, S. A. MAJETICH, Physics Dept, Carnegie Mellon University — Magnetic tunnel junctions have been studied extensively for their magnetoresistance and potential uses in magnetic logic and data storage devices, but little is known about how their performance will scale with size. Here we examined the electronic behavior of 12 nm diameter magnetic tunnel junctions fabricated by a novel nanomasking process. Scanning electron microscopy images indicated feature diameter of 12 nm, and atomic force microscopy showed a height of 5 nm suggesting that unmasked regions have been milled on average to the oxide barrier layer, and areas should have the remnants of the free layer exposed with no remaining nanoparticle. Electrical contact was made to individual nanopillars using a doped-diamond-coated atomic force microscopy probe with a 40 nm radius of curvature at the tip. Off pillar we observed a resistance of 8.1 x 10^5 Ω, while on pillar we found a resistance of 2.85 x 10^6 Ω. Based on the RA product for this film, 120 $\Omega - \mu\text{m}^2$, a 12 nm diameter cylinder with perfect contact would have a resistance of 1.06 x 10^6 Ω. The larger experimental value is consistent with a smaller contact area due to damaging the pillar during the ion milling process. The magnetoresistance characteristics of these magnetic tunnel junctions will be discussed.

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