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Switching Properties of sub-100 nm Perpendicular Magnetic Tunnel Junctions[1] LARYSA TRYPUTEN, Massachusetts Institute of Technology, STEPHAN PIOTROWSKI, MUKUND BAPNA, Carnegie Mellon University, CHIA-LING CHIEN, Johns Hopkins University, WEIGANG WANG, University of Arizona, SARA MAJETICH, Carnegie Mellon University, CAROLINE ROSS, Massachusetts Institute of Technology — Perpendicular magnetic tunnel junctions (p-MTJs) have great potential for realizing high-density non-volatile memory and logic devices. It is critical to solve scalability problem to implement such devices, to achieve low resistance area and to reduce switching current density while maintaining thermal stability. We present our recent results on fabrication of high resolution Ta/CoFeB/MgO/CoFeB/Ta p-MTJ devices and characterization of their switching properties as well as topography and current mapping by using nanoscale Conductive Atomic Force Microscopy. Our patterning method is based on using hydrogen silsesquioxane resist mask combined with ion beam etching. It allows to fabricate p-MTJ devices down to 40 nm in diameter while maintaining the magnetic quality of the multilayers. Repeatable, consistent switching behaviour has been observed in the obtained p-MTJ devices of 500 nm down to 40 nm with 10 – 800 mV voltage applied. Switching field increased as device diameter decreased, from 580 Oe at 500 nm (MR = 10%) to 410 Oe at 80 nm (MR = 9%). We discuss the effect of device sizes on the switching properties.

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