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Ultrafast Switching in Magnetic Tunnel Junction based Orthogonal Spin Transfer Devices HUANLONG LIU, DANIEL BEDAU, DIRK BACKES, JORDAN KATINE, JÜRGEN LANGER, ANDREW KENT, NEW YORK UNIVERSITY, NEW YORK, NY 10003 USA TEAM, HITACHI-GST, SAN JOSE, CALIFORNIA 95135 USA TEAM, SINGULUS, 63796 KAHL AM MAIN, GERMANY TEAM — Orthogonal spin-transfer magnetic random access memory (OST-MRAM) uses a spin-polarizing layer magnetized perpendicularly to the free layer to achieve large spin-transfer torques and ultrafast energy efficient switching. We have fabricated and studied OST-MRAM devices that incorporate a perpendicularly magnetized polarizer and a magnetic tunnel junction, which consists of an in-plane magnetized free layer and synthetic antiferromagnetic reference layer. A switching probability of 100% is observed for 500 ps pulses, requiring an energy of 250 fJ. The fast switching process indicates there is no incubation delay of several nanoseconds as observed in conventional collinear magnetized devices. Due to the perpendicular polarizer switching is possible for both pulse polarities. There is also evidence for precessional switching in the non-monotonic dependence of the switching probability versus pulse amplitude. This work was supported by Spin Transfer Technologies.

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