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Electrical Control of Magnetization in Semiconductors[1]

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Ferromagnetic III-V semiconductor (Ga,Mn)As is characterized by $p-d$ exchange stabilized ferromagnetism, small magnetization, and strong spin-orbit interaction [1, 2], thus offering a unique combination of physics related to current-induced magnetization reversal. Here we present our study on (1) current driven magnetic domain wall motion in a lithographically defined (Ga,Mn)As structure [3], and (2) current driven magnetization reversal in fully epitaxial (Ga,Mn)As magnetic tunnel junctions (MTJ's) using GaAs as a barrier [4]. In the former, two regimes are found to be present in the velocity - current density characteristics and the estimated spin-transfer efficiency is as high as 10% or even higher. In the latter, current density required for the reversal in MTJ is found to be lower than that expected from scaling of magnetization. [1] H. Ohno, Science, 281, 951 (1998). [2] T. Dietl *et al.*, Science, 287, 1019 (2000). [3] M. Yamanouchi *et al.*, Nature, 428, 539 (2004). [4] D. Chiba *et al.*, accepted for publication in Phys. Rev. Lett.

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