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Magnetic Tunnel Junctions (MTJ) with Large Tunneling Magnetoresistance (TMR) and Small Saturation Fields WILLIAM EGELHOFF, JR., VOLKER HOEINK, JUNE LAU, NIST, WEIFENG SHEN, Brown University, BENAIAH SCHRAG, Micro Magnetics, Inc., GANG XIAO, Brown University — There is a continuing need for more sensitive magnetic sensors. We report here an approach that leads to MTJ structures at the wafer level that have TMR values in excess of 100% and saturation field (B_{sat}) values below 1 Oe. The ratio appears to be the largest ever reported. The approach we have used is to fabricate and anneal MTJs of a rather conventional type, SiO2/5Ta/30Ru/5Ta/2CoFe/15IrMn/2CoFe/0.9Ru/ 3CoFeB/2MgO/ 5CoFeB/5Ta/10Ru (thicknesses in nm), then etch down into the free layer of the MTJ, and deposit a thick (100 nm) and very soft magnetic film to lower B_{sat}. We have found that incorporating the soft film in the initial structure lowers the TMR significantly upon annealing. Maintaining a large TMR depends on depositing the soft film after annealing. A static field of 1.8 Oe is applied perpendicular to the sweep field (*i.e.* in the hard axis) to suppress the hysteresis of 1.3 Oe. This technique is described in Ref. 1. The sweep field is in the easy axis of the free layer and the side field is in the hard axis of the free layer. The low-field loop is linear, non-hysteretic, and extrapolates to saturation at 0.8 Oe. The measured TMR is 118%. 1) X. Liu, C. Ren, and G. Xiao 92, 4722 (2002).

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