Abstract Submitted
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Bias dependence of Fe-MgO-Fe magnetic tunnel junction devices within a single-band tight-binding model TEHSEEN RAZA, School of Electrical and Computer Engineering, Purdue University, West Lafayette, IN 47907, HASSAN RAZA, School of Electrical and Computer Engineering, Cornell University, Ithaca NY, 14853 — We have developed a transferable single-band tight-binding model benchmarked with the ab initio methods for Fe-MgO-Fe magnetic tunnel junction (MTJ) devices [1]. The computational complexity of our model is on the order of an effective mass one, but additionally it includes the bandstructure physics over the two-dimensional transverse Brillouin zone in an average manner. We study the bias dependence of the tunnel magnetoresistance (TMR) ratio in MTJ devices. At low bias, for both the 4-layer and 12-layer MgO barrier, the TMR is bias-independent. It is higher for the 12-layer device due to relatively a larger decrease in the AP current density. At high bias, our model predicts a sharp roll-off in TMR ratio, which is attributed to a rapid increase in the Delta_1 band current density in the anti parallel (AP) configuration due to the bandedge states entering the conduction window. The TMR ultimately becomes negative when the AP current becomes higher than the P current due to the different k-states tunneling through the same barrier. [1] T. Z. Raza and H. Raza, arXiv:0804.2557

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