Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Impact of electrode crystallization and of impurity diffusion on barrier-resistance noise in CoFeB/MgO/CoFeB tunnel junctions[1] RYAN STEARRETT, LUBNA SHAH, XIAOMING KOU, XIN FAN, JOHN XIAO, EDMUND NOWAK, University of Delaware — We have measured the changes of TMR and of barrier $1/f$ resistance noise in sputtered, MgO-based MTJs as a function of annealing time at 250, 380, and 430 °C. Although the behavior of TMR and of noise are anticorrelated at 380 and 430 °C, the degree of crystallinity in CoFeB electrodes cannot account for drop in noise. An upper bound on electronic $1/f$ noise from metal layers of materials stack is estimated to be many orders of magnitude less than measured value. Hence, electronic noise must be related to properties of barrier. Also, annealing at 250 °C yields a steady decrease in noise while TMR remains mostly unchanged. Lastly, it is observed that parallel (P) state differential conductance begins to decrease at relatively short times of annealing at 430 °C, suggesting that impurity diffusion is appreciable. Yet, noise continues to decrease around this time period. At longer times noise is essentially independent of time whereas P state differential conductance continues to decrease, indicating that impurities have a stronger effect on the conductance than on barrier noise. We conclude noise is attributed to oxygen vacancy defects in MgO tunnel barrier.

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Date submitted: 07 Dec 2009 Electronic form version 1.4