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Evolution of low-frequency resistance noise during annealing in CoFeB/MgO/CoFeB tunnel junctions[1] RYAN STEARRETT, WEIGANG WANG, LUBNA SHAH, EDMUND NOWAK, JOHN XIAO, University of Delaware — We have studied the evolution of tunneling magnetoresistance (TMR) and resistance noise in magnetic tunnel junctions (MTJs) as a function of annealing time at 425^{o}C. Previously, we showed that short annealing times do lead to significant improvement in the MgO crystal structure and crystallization of the CoFeB electrodes, resulting in large TMR values up to 200%. We also observe that the low-frequency resistance noise decreases significantly after annealing for only a few minutes. The resistance noise has a 1/f spectrum and is quantified by a Hooge-like parameter, α, given in units of μm^2. In unannealed samples α is of order 10^{-9} μm^{2}and decreases with increasing voltage bias. Upon annealing, α drops to 10^{-10} μm^{2}and is less dependent on bias, particularly in the parallel configuration. We attribute the decrease in α and its bias dependence, α(V), to a reduction of defects in and around the barrier due to annealing. The implications for optimizing the signal to noise ratio of MgO-based MTJ sensors will also be discussed.

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