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Enhancement of tunneling electroresistance in multiferroic tunnel junctions by ferroelectric driven phase transition Y.W. YIN, Penn State, J.D. BURTON, University of Nebraska, Y-M. KIM, A.Y. BORISEVICH, S.J. PENNYCOOK, Oak Ridge National Laboratory, S.M. YANG, T.W. NOH, Seoul National University, A. GRUVERMAN, University of Nebraska, X.G. LI, University of Science and Technology of China, E.Y. TSYMBAL, University of Nebraska, QI LI, Penn State — A multiferroic tunnel junction (MFTJ), employing a ferroelectric (FE) barrier sandwiched between two ferromagnetic (FM) electrodes has become a promising multifunctional device for practical use. Large resistance difference between states is critical for utilizing MFTJ as resistance switch. To increase the tunneling electroresistance (TER) effect, we have designed a La0.7Sr0.3MnO3(LSMO)/BaTiO3(BTO)/La0.5Ca0.5MnO3(LCMO)/LSMO MFTJ in which a FM metallic to antiferromagnetic (AFM) insulating phase transition in LCMO due to interfacial charge doping occurs when the FE polarization of BTO is pointing opposite to LCMO. The metal to insulator transition of LCMO will increase the tunneling barrier width which was verified by transport fitting. While the FM to AFM transition of LCMO will reduce the transmission probability of spin polarized tunneling electrons, which also suppresses tunneling magnetoresistance effect. This is supported by high magnetic field measurement demonstrating that the suppressed AFM order leads to the TER reduction. Both the barrier width increase and transmission probability reduction will significantly increase the resistance difference between two polarization states, and an increase of TER from 30% to 10,000% was obtained.

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