Abstract Submitted
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Spin-dependent Quantum Well States in Magnetic Tunnel Junctions[1] YAN WANG, XIUFENG HAN, Institute of Physics, CAS, China, ZHONG-YI LU, Institute of Theoretical Physics, CAS, China, X.-G. ZHANG, Oak Ridge National Laboratory, USA — MgO crystalline oxide based magnetic tunnel junctions (MTJs) and double barrier MTJs (DBMTJs) have attracted much recent attention due to the observation of large tunneling magnetoresistance (TMR) ratio and realization of quantum size effect in epitaxial structures. Using first-principles calculations, we show that the TMR ratio is reduced by an ultrathin Mg insertion layer although experimentally it can improve the orientation of the MgO(001) barrier layer. We also confirm that spin-dependent quantum well (QW) states exist in the middle film in DBMTJs, and large TMR can be realized by resonant tunneling effect through these states. However, at a small bias, large MgO thickness for DBMTJs is prerequisite for achieving TMR as high as single barrier MTJs without resonant tunneling effect. We also discover that the Coulomb blockade effect plays a dominant role in the smearing of the QW resonances.

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