Effect of Metallic interlayers in MgO-based Magnetic Tunnel Junctions

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Since the theoretical prediction and experimental observations of the giant tunneling magnetoresistance (TMR) effect in magnetic tunnel junctions (MTJs) with a single-crystalline MgO(001) barrier, these MTJs have been extensively studied due to their broad potential applications in spintronic devices. This presentation covers very recent progress in theoretical calculations in a few select topics related to MgO-based MTJs. Specifically, we focus on the Layer-KKR first-principles method based theoretical studies of electronic structure and spin-dependent transport properties of MgO-based MTJs with different metallic interlayers, including structures of Fe(001)/Mg/MgO/Fe and Fe(001)/Co/MgO/Fe, as well as comparisons with recent experiments. An important role of the non-magnetic Mg interlayer is identified to be preserving the preferential transmission of the majority-spin states with \(\Delta_1\) symmetry, which dominates the spin-dependent transport of MTJs with MgO barriers.

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