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A novel reduced symmetry oxide ($Mg_3B_2O_6$) for magnetic tunnel junctions based on FeCo or Fe leads DEREK STEWART, Cornell Nanoscale Facility, Cornell University — Magnetic tunnel junctions with high TMR values, such as Fe|MgO|Fe, capitalize on spin filtering in the oxide due to the band symmetry of incident electrons. However, these structures rely on magnetic leads and oxide regions of the same cubic symmetry class. This raises the question of whether reducing the oxide symmetry can enhance spin filtering. A new magnetic tunnel junction (FeCo|$Mg_3B_2O_6$|FeCo) is presented that uses a reduced symmetry oxide region (orthorhombic) to filter spins between two cubic magnetic leads. Symmetry analysis of coupling between states in the cubic leads and the orthorhombic oxide indicates that majority carrier tunneling through the oxide should be favored over minority carriers. Complex band structure analysis of $Mg_3B_2O_6$ shows that the relevant evanescent states in the band gap are due to boron p states and that there is sufficient difference in the decay rates of the imaginary bands for spin filtering to occur. Electronic transport calculations through a Fe|$Mg_3B_2O_6$|Fe magnetic tunnel junction are also performed to address the possible influence of interface states. Some recent experimental studies of FeCoB|MgO|FeCoB junctions, with B diffusion into the MgO region, indicate that this new type of junction may have already been fabricated. The prospect of developing a general class of magnetic tunnel junctions based on reduced symmetry oxides is also examined.

Derek Stewart
Cornell Nanoscale Facility, Cornell University

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