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**Interlayer Exchange Coupling in Fe|MgO|Fe Magnetic Tunnel Junctions**

T. KATAYAMA, S. YUASA, National Institute of Advanced Industrial Science and Technology (AIST), JULIAN VELEV, S. JASWAL, E. TSYMBAL, University of Nebraska - Lincoln — Fully epitaxial Fe|MgO|Fe(001) films with wedge-shaped MgO layer were prepared on single-crystal MgO(001) substrates using MBE technique [1]. Structure of the films is Fe-free-layer(15, 20, 30 nm)/MgO(0.3-1.8 nm)/Fe-pinned-layer(10 nm)/Ir-Mn. The interlayer exchange coupling (IEC) energy was obtained at room temperature from a unidirectional shift of the Kerr hysteresis loop. The IEC was found to be antiferromagnetic for small MgO thickness but changed sign at 8.5Å. In order to explain this behavior we performed *ab-initio* calculations of IEC in Fe|MgO|Fe(001) MTJs with and without oxygen vacancies in MgO. Our results show that without O vacancies the IEC is ferromagnetic and decays exponentially with MgO thickness. However, in the presence of O vacancies the IEC is antiferromagnetic for thin barriers and changes sign with increasing barrier thickness. This behavior is consistent with our experimental observations and is explained by the resonance contribution to the IEC due to localized defect states [2]. [1] S. Yuasa *et al.*, Nature Mater. **3**, 868 (2004). [2] M. Y. Zhuravlev *et al.*, Phys. Rev. Lett. **94**, 026806 (2005).

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