

Optimization of MgAl_2O_4 (MAO) Spinel -type Barrier for Magnetic Tunnel Junctions

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Spinel-type MgAl_2O_4 (MAO) barriers may be a promising alternative for MgO barriers in magnetic tunnel junctions. To this end, we compared results on films grown by pulsed laser deposition from a stoichiometric MAO target with those co-sputtered from elemental Mg and Al targets and in-situ and ex-situ annealed in flowing oxygen at various temperatures. Scanning electron microscopy, energy-dispersive X-ray analysis, X-ray diffraction, atomic force microscopy and magnetometry was carried out to characterize this potential barrier material. For both deposition techniques some spinel-type growth was seen after process optimization. The PLD technique has a very low growth rate, which may be improved by co-ablation from oxide targets. The co-sputtering process was optimized to achieve stoichiometric growth, and traces of spinel-type crystal formation were seen for a combination of in-situ and post-deposition annealing in flowing oxygen. Future research will focus on the development of magnetic tunnel junctions using this barrier material, and comparing them with MgO and alumina barriers.