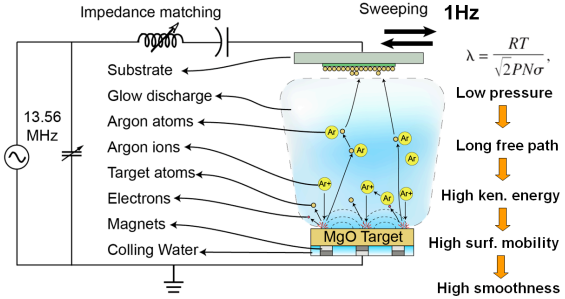
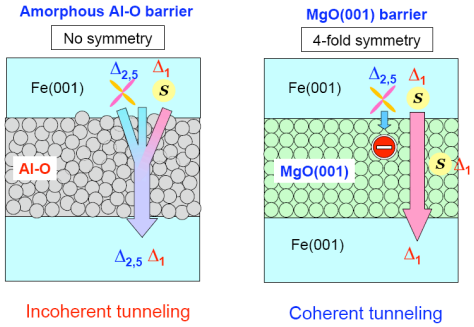
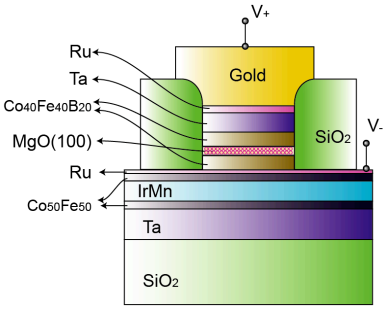
A New Generation of Spintronic Devices: MgO Magnetic Tunneling Junctions
MRSEC (Johns Hopkins University) DMR05-20491

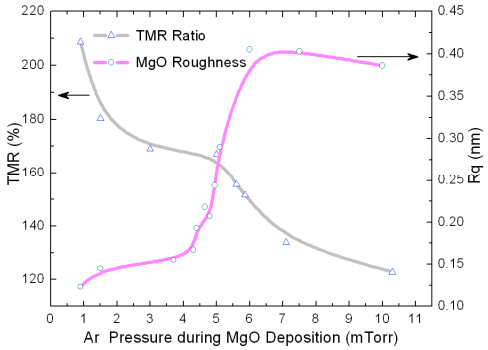


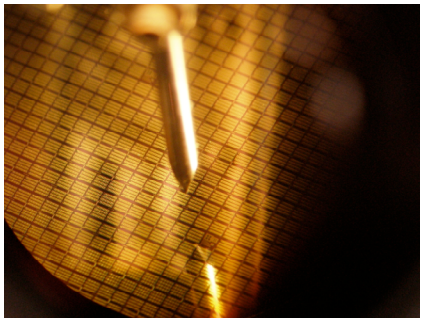


We developed a low-pressure magnetron sputtering technique together with the linear dynamic deposition method and successfully fabricated a new type of magnetic tunneling junctions (MTJs) with (001) textured MgO barrier. We are the only US university to have achieved this success as of April 2007.

MgO-based MTJs exhibit magnetoresistance exceeding 200% at room temperature and low field, a major breakthrough in spintronics. The physics is coherent spin dependent tunneling, where only electron wavefuctions with certain symmetry can tunnel through.







Schematics of a MgO-based MTJ that requires modern thin film deposition and lithography. The key to our success is to minimize the interfacial roughness using low pressure sputtering.

We have achieved the best performance in MgO-based MTJs worldwide. Our mass production of these MTJs is used for industrial applications of metrology, magnetic sensing,and spintronic immunoassay.

Weifeng Shen, Dipanjan Mazumdar, Xiaojing Zou, Xiaoyong Liu, B. D. Schrag, and Gang Xiao "Effect of film roughness in MgO-based magnetic tunnel junctions", Applied Physics Letter ***88****, 182508 (2006).*

May 2007