Voltage Controlled Magnetic Anisotropy Change in Different Temperature Annealed Magnetic Tunnel Junctions

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MgO-based magnetic tunnel junction (MTJ) [1] is of great interest as a non-volatile memory. Voltage controlled magnetic anisotropy (VCMA) [2] is an ideal technology in such a memory devices. CoFeB/MgO system has been employed in MTJs as well as VCMA studies. [3] Although perpendicular magnetic anisotropy in CoFeB/MgO has large change after post-anneling, post-anneling temperature dependence of VCMA has not been clarified yet. In this study, we have fabricated Ta/CoFeB/MgO/CoFeB MTJs with different post-anneling temperature, and characterized the VCMA of CoFeB.

In order to investigate VCMA change at different annealing temperature, Ta(5nm)/Ru(20nm)/Ta(5nm)/CoFeB(1.1nm)/MgO(1.9nm)/CoFeB(5nm)/Ta(5nm)/Ru(5nm) layers were deposited on Si/SiO2 substrate in sputter system and MTJ was fabricated with 10μm² junction area with various fabrication steps: photolithography, Ar ion milling, SiO2 deposition, electron beam deposition steps. Samples have been annealed at different temperatures: processing temperature, 200°C, 250°C, 300°C, 350°C for 1 hour. We have measured annealing temperature dependence of tunnel magnetoresistance curve under different bias voltage Figures (a) and (b) show the perpendicular magnetic field dependence of normalized resistance change with annealing temperature of 200°C and 300°C, respectively.

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![Figure (a) and (b) Perpendicular magnetic field dependence of normalized resistance under different bias voltage with annealing temperature of 200°C and 300°C, respectively.](image)

**References:**