

Structural and electrical characterization of MgO thin films grown on various ferromagnetic substrates

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MgO thin films have been prepared on various ferromagnetic substrates by r.f magnetron sputtering at room temperature. We observed that the MgO thin films with (002) fiber texture was obtained on amorphous materials such as CoZrNb and CoFeSiB, but it wasn't on polycrystalline such as CoFe and Fe, as shown in Fig.1. The poor crystallinity of MgO on CoFe and Fe may have been due to a large lattice mismatch and the textured MgO due to the formation of the denser and smaller nuclei at the initial stage.[1,2] In order to investigate the TMR effect of the MTJ using crystalline and non-crystalline MgO, we have fabricated MTJs, of which structure was bottom pinned. The MTJ using MgO on amorphous pinned layer as a tunnel barrier have higher TMR value. However, Both of them were below 40%. We thought that its low TMR value resulted from low spin polarization of ferromagnetic and the over-oxidation of interface between MgO and pinned layer due to the oxygen radical originated from sputtering target.[3] Changing top and bottom ferromagnetic layer and optimization of MgO deposition process, we acquire more high TMR value, 83%, which the structure of MTJs was IrMn/CoFeB/MgO/CoFeB and the post heat treatment performed in vacuo at 250 °C for 1 hr.

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