

New barrier materials for MTJ

Keywords: Spintronics, MRAM

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Background

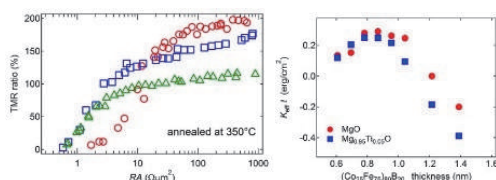
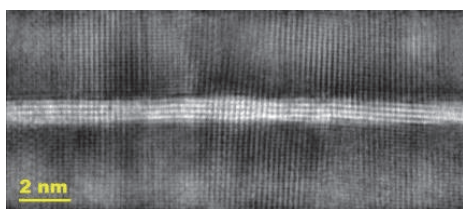
- Magnetic tunnel junction (MTJ) shows huge magnetoresistance.
- Further improvement of transport properties is necessary to realize the spin-transfer-torque magnetic random access memories (STT-MRAMs) and read heads for next generation.

Aim

- Realizing the low-RA MTJs with MgO tunneling barrier
- Finding the alternative tunneling barrier materials proper for the STT-MRAM and read head application.

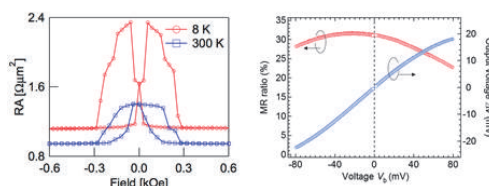
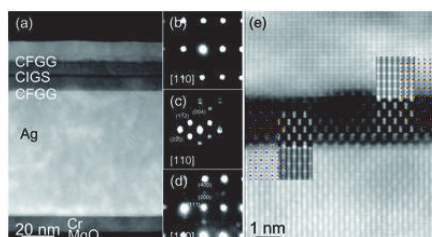
Advanced Research Topics

Low-RA MTJs using Ti doped MgO



- ◆ MR is recovered by doping Ti for low-RA range below 10 $\Omega\mu\text{m}^2$.
- ◆ Similar intensity of interface induced magnetic anisotropy.

Low-RA MTJs using semiconductive CIGS spacer



- ◆ Epitaxial growth of a CIGS layer on top of metal electrodes
- ◆ Large MR more than 40 % at RA and more than 100 % at LT in low RA range between 0.3 to 3 $\Omega\mu\text{m}^2$.

Publications

- Ikhtiar, SK *et al.*, Appl. Phys. Lett. **108**, 242416 (2016)
- S. Kasai *et al.*, Appl. Phys. Lett. **109**, 032409 (2016)
- K. Mukaiyama, SK *et al.*, Appl. Phys. Express **10**, 013008 (2017)

Summary

- Ti-doped MgO barrier shows the larger MR compared to MgO barrier at low RA range below 10 $\Omega\mu\text{m}^2$.
- Non-oxide semiconductors, specially CIGS, achieve large MR in low RA range between 0.3 to 3 $\Omega\mu\text{m}^2$.

Research outcome

- Improving the output properties.
- Realizing the perpendicular magnetized film with CIGS interlayer.
- Realizing the poly-crystalline device.