ATOMIC LAYER DEPOSITION OF ZrO_2:Fe_2O_3 THIN FILMS

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Doped ZrO_2 has been an object of interest due to its several potential applications, for example in microelectronics as a memory material [1]. In this study, ZrO_2:Fe_2O_3 films were grown by atomic layer deposition (ALD) on planar Si(100), TiN, Ru and 3D silicon substrates by alternately applying certain amounts of constituent binary oxide growth cycles. $ZrCl_4$ and $Fe(C_5H_5)_2$ were used as zirconium and iron precursors, respectively. The oxidizer was O_3.

The film thicknesses, measured by spectroscopic ellipsometry, varied between 15 and 39 nm. The films were deposited uniformly on a 3D stacked silicon surface, with aspect ratio 1:20 (not shown). Doping ZrO_2 with small amounts of Fe [Fe/(Fe+Zr)=0.05-0.20] stabilized the tetragonal phase of ZrO_2 (not shown). Fig. 1 shows that in the case of ZrO_2:Fe_2O_3 cycle ratio 10:5, sample on Si(100) shows saturation magnetization, sample on Ru shows hysteretic I-V curves, which could be related to certain resistive switching behaviour and sample on TiN shows certain charge polarization.

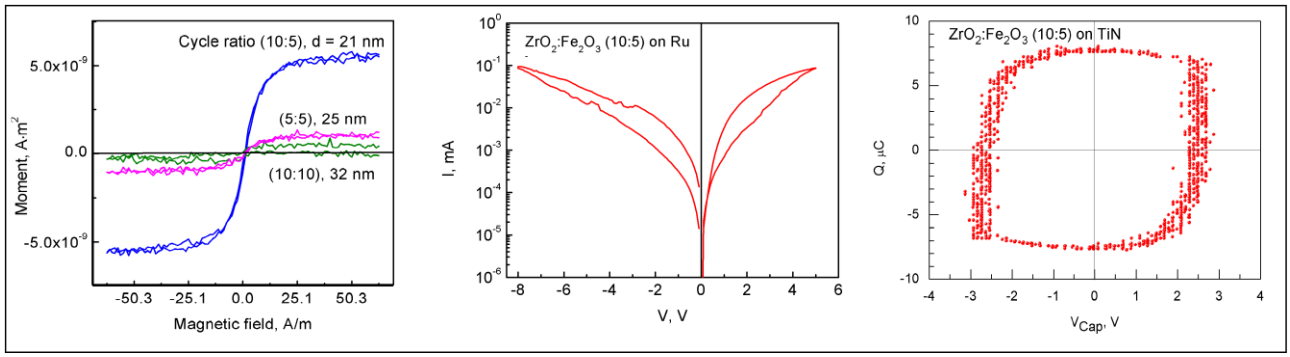

Fig.1 Magnetic moment in selected samples of ZrO_2:Fe_2O_3 films on Si(100) substrate with respect to external magnetic field, measured by vibrating sample magnetometer on the left panel. Current-voltage curve of ZrO_2:Fe_2O_3 film with cycle ratio (10:5) on Ru substrate on middle panel and polarization charge – applied voltage curve for the sample on TiN with cycle ratio (10:5) on the right panel.

[1] Leskelä, M., Niinistö, J., Ritala, M., Atomic Layer Deposition. In Comprehensive Materials Processing; Cameron, D., Ed.; Elsevier Ltd., 2014; Vol. 4, pp 101–123

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