Low temperature porous Ta_2O_5 films. Towards hybrid molecular/high-k oxides for non-volatile memory applications.

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In this work we study the potential of utilization of porous Ta_2O_5 oxide films grown under ambient temperature conditions either as gate dielectrics in hybrid molecular/semiconductor memory elements or as charge trapping medium reliant on interface dipole engineering. The partially ionic nature of the incorporated charged molecules induces the presence of interface dipoles, changing the band lineup across the interfaces of the MOS stack [1]. This phenomenon can be exploited to modulate the flat band voltage shift and improve the properties of the high-k dielectric at the same time [2].

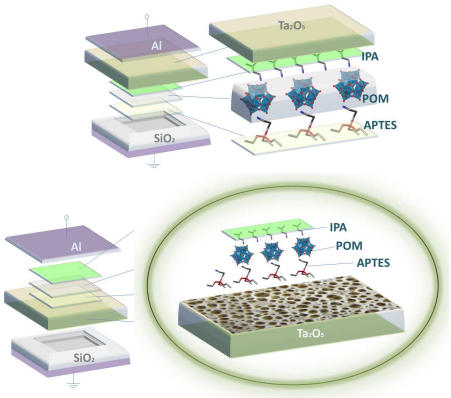

Figure 1: Schematics of the fabricated MIS capacitor memory stacks incorporating low temperature Ta_2O_5 and self-assembled POM oligolayer on SiO_2. On top the tantalum oxide layer is grown on the active molecular oligolayer playing the role of gate oxide. At the bottom the porous surface of the oxide serves as a large effective templating surface for the self-assembly of the active molecules. The latter results in a high density molecular layer with well-defined structural and interfacial properties.

References

[1] Yasuyuki Hikita, Mitsuru Nishikawa, Takeaki Yajima and Harold Y. Hwang, Phys. Rev. B, **79**, 073101, (2009).

[2] A. A. Pavel and N. Islam, IEEE Trans. Nanotechnol. **9**, 345, (2010).

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