Poster Presentation

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Composition profiles across MIMs for resistive switching studied by EDS and EELS

F. Hanzig[1], J. Veselý[1], M. Motylenko[1], A. Leuteritz[1], H. Mähne[2], T. Mikolajick[2,3], D. Rafaja[1]

[1]TU Bergakademie Freiberg, Institute of Materials Science, Freiberg, Germany, [2]NaMLab gGmbH, Dresden, Germany, [3]TU Dresden, Institute of Semiconductors and Microsystems, Dresden, Germany

Resistive switching in MIM (metal-insulator-metal) stacks is an effect that enables a promising data storage technology which is able to overcome the size limitations of conventional non-volatile memories. The resistive switching effect was already demonstrated for several binary as well as ternary transition metal oxides (TiO2, NiO, SrTiO3, Nb2O5) [1,2]. The current models of the switching mechanisms suggest the important role of defects like oxygen vacancies [3]. Here, we report on the local structural and electronic properties of transition metal oxides embedded in MIM stacks that were obtained by using transmission electron microscopy and electron spectroscopy. We focus on the development of the stoichiometry across the MIM stack for amorphous and partial crystalline niobium oxides. Therefore, electron energy loss spectra (EELS) as well as the energy dispersive X-ray spectra (EDS) were collected on the atomic scale utilizing a nanometer probe in the scanning transmission electron microscope (STEM). The differences in the oxygen content among the electrodes and the concentration profiles at the metal/oxide interfaces in particular were investigated in dependence on the preparation method and on the electrode material. Besides, focusing on the electron loss near edge structure (ELNES) of the oxygen K edge we employed simulations using FEFF9 to describe the modifications of the electronic structure with variations in the oxygen content.

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