PhD position:

*In-situ* operation of oxide-based memories in a transmission electron microscope

There is a great deal of activity in the development of new memory technologies that can be used to provide the required density and reliability for future generations of data storage. At this time there is a bewildering array of proposed systems each with advantages and disadvantages. One of the problems with the development of these types of materials systems is that it is not clear exactly how these devices function and as a consequence, it is difficult to select the best combinations of materials to provide the best overall performance.

Within this PhD subject we will study the role of structure and oxygen in the switching process for different types of specimens by analysing the devices *in situ* in the TEM. Techniques such as EDS (Energy dispersive X-Ray Spectroscopy) or EELS (Electron Energy Loss Spectroscopy) will be developed for the measurement of oxygen concentration (atoms) and electron holography for the measurement of the changes in electrostatic potential caused by the movement of the oxygen. Conventional techniques such as aberration-corrected high-resolution STEM imaging will be available for the assessment of the changes in device structure.

This work will be at the leading edge of *in situ* electron microscopy and will develop methods to routinely measure the changes in structure, composition and fields in nanoelectronic devices. We will combine the expertise that is available in the different laboratories for materials deposition, electrical testing, modelling and advanced *in situ* characterisation to provide accurate information about how complex memory devices work at an atomic scale.

We are currently looking for a PhD-level researcher who will join a team working towards this objective using off-axis electron holography, STEM EELS and state-of-the-art specimen preparation techniques. We are looking for a dynamic, self-starter who is interested in this subject. The candidate must be happy to work in a team environment. The candidate must also possess a Masters degree in a relevant subject. A background in characterisation would be advantageous.

At Minatec characterisation facilities, such as a Monochromated FEI Titan Ultimate TEM, with Cs image and probe correctors, Lorentz lens, Gatan energy filter and an electron biprism are available. Additional TEMs available include a probe corrected FEI Themis equipped for electron holography, a FEI Osiris with ChemiSTEM and a FEI Tecnai. We also have three different dual beam focused ion beam (FIB) systems. In situ experiments will be performed using a Protochips Aduro 500 and Nanofactory systems.

Grenoble and Minatec, situated in the French Alps offer a fantastic quality of life combined with excellent research facilities and competitive rates of pay. www.minatec.com

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