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Mapping nanofields by Electron Holography

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Transmission Electron Microscopy (TEM) is a powerful tool for the quantitative studies at the atomic scale of structures, microstructure, chemistry and electronic structures of (nano)materials. In conventional TEM only the intensity and energy loss distribution of the electronic beam is measured, while information concerning the phase shift of the electron wave is lost. The phase of the e-beam is however sensitive to the electrostatic and magnetic fields the beam has interacted with [1] and to strain fields in crystalline materials as well [2]. Measuring the e-beam phase shift then permits to map the configuration of these fields at the nanometer scale and get quantitative measurements of the local magnetization, the electrical charges and/or strain. Electron holography (EH) is an interferometric method which allows the amplitude and the phase shift of the high energy electron wave to be recorded. I will show that EH is able to quantify and map local electrostatic and magnetic fields (both inside the sample and in the surrounding leakage fields) and strain fields with a resolution of the order of few nanometers on large field of view. I will illustrate the potentialities EH studying the electrical charges in MgO nanocubes [3] and presenting several studies carried out these last years on magnetic nanowires of various size, crystal structures and morphologies [4-6] combined with micro-magnetic simulations.

Biography

E. Snoeck has completed his PhD in1986 at the Laboratoire d'Optique Electronique (LOE) in Toulouse University. He is CNRS Research Fellow since 1989 and the director of the CEMES-CNRS laboratory since 2015. He has published more than 240 papers in journals and 7 chapters in scientific books

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