Low energy electron microscopy: from basic principles to surface dynamics of semiconductors

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In this presentation, I first discuss the basic principles of low energy electron microscopy (LEEM). I describe the main imaging modes of material surfaces by LEEM using the reflected and diffracted electrons by the surface. This overview is complemented selecting the most important related techniques to address crystallographic, magnetic and chemical properties using respectively LEED, spin-polarized LEEM and PEEM techniques. In a second part the major advantages of LEEM are addressed: the possibility to study in real-time the spatio-temporal dynamics of surfaces under non-equilibrium conditions through selected examples in the context of semiconductor physics. The thermal de-oxidation [1-3] and the solid state dewetting of silicon [4,5] on silica (Silicon-On-Insulator, see Fig.1) are quantitatively studied, taking advantage of the multiscale imaging potentialities of LEEM. Then I will focus on the growth of metallic eutectic nanodroplets on silicon surfaces, as seeds for nanowire growth [6,8]. At last it will be shown that LEEM allows addressing electro- and thermo-migration processes at surfaces with unprecedented accuracy by measuring the drift velocity of single atomic step edges [9-12].

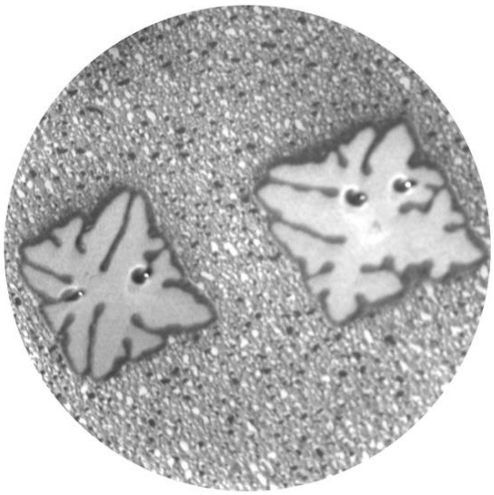

Fig. 1: LEEM image of Silicon-On-Insulator surface during solid state dewetting at 850°C. Field of view: 25 µm.

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