

COUPLING X-RAY SPECTROSCOPY AND SCANNING PROBE MICROSCOPY FOR SIMULTANEOUS SAMPLE TOPOGRAPHY AND CHEMICAL MAPPING

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Scanning Probe Microscopies (Scanning Tunnelling Microscopes (STM), Atomic Force Microscopes (AFM), Shear Force Microscopes (SFM)...) are powerful tools for surface topography analysis at high lateral resolution. However, these equipments cannot provide a priori chemical mapping of the analysed surface. X-Ray Spectroscopy is a fine surface analysis technique allowing to define chemical and structural properties of a material. The lateral resolution for chemical mapping is limited by the X-ray primary beam focusing optics in the range of 20-50 nm for soft X-rays (<4 keV) and 100-1000 nm for hard X-rays (>4 keV). However, in these experiments it is not possible to simultaneously acquire the sample topography and thus it is not possible to perform a spectroscopy on a given micro- or nano-object somewhere on the surface.

We have designed and fabricated a Shear Force Microscope head allowing to obtain simultaneously with the same apparatus and in ambient conditions, the sample topography and chemical mapping by XRF or XAFS-XEOL [1, 2]. In the former case, a sharp optical fibre is used as shear force probe for sample topography and for simultaneous collection of the visible luminescence under focused X-ray excitation (resolution 50 to 100 nm for both topography and chemical analysis). In the latter configuration, an X-ray capillary replaces the optical fibre to collect the X-ray sample fluorescence (resolution of 100 nm expected).

References

1. M. Dehlinger et al., Small, to be published (2011).
2. C. Fauquet et al., Nanoscale Research Letters, accepted for publication (2011).