X-ray micro-analysis activities at the ESRF

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The X-ray microscopy activities at the ESRF have to be considered in the broad context of the development of synchrotron based multi-keV micro-analysis techniques. This evolution aims not only at following the evident trend of nano-technologies by pushing spatial resolution to new limits, but also at providing novel and complementary analysis techniques: considering the concomitant developments of high performance laboratory instruments and the construction of new dedicated synchrotron beam lines worldwide, a highly competitive context can be anticipated for the coming years. Synchrotron based X-ray micro-analytical techniques (diffraction, imaging and spectro-microscopies) will play a crucial role by offering unique capabilities (3D information, time-resolved, chemical selectivity,…).

Among the 40 beamlines in operation at the European Synchrotron Radiation Facility, three are fully dedicated to X-ray microscopy and micro-spectroscopy techniques in the multi-keV range (2-30keV). In the past three years our R&D activities have been focussed on three major programmes:

i) *In-situ experiments*: non-uniform systems in the three broad categories of earth/environmental, material/archaeological and chemical/biological sciences, in which spatial inhomogeneity of the order of the micron or below is omnipresent. X-ray microprobe applications should evolve towards two dimensional mapping of valence state / local structure on the (sub)micron scale in both stable and time dependant inhomogeneous systems under controlled conditions (temperature and pressure).

ii) *New detection techniques*: the solid-state energy dispersive detectors used until recently at ID21 and ID22 offer limited solid angle coverage of a few 10^{-2} sterad. On one hand, significant efforts are being made to enhance fluorescence collection by optimising detector geometry, while on the other, new detection techniques such as phase contrast and XEOL are proposed.

iii) *A new FTIR spectro-microscopy endstation*: most of our scientific cases require a multi-modal approach, consisting of a combination of analytical techniques providing chemical as well as structural information. There is therefore a strong interest to perform different measurements on the same sample under optimal conditions. The availability of a synchrotron based IR spectro-microscopy instrument, complementing hard (ID22) and soft (ID21) X-ray spectro-microscopy beamlines will constitute a unique micro - characterisation facility.

An overview of these activities will be given. New developments will be presented and illustrated by examples of scientific results.