Linking structure with chemical and electronic properties of crystalline surfaces and interfaces

Jörg Zegenhagen
ESRF, Grenoble, France

The potential of the x-ray photoelectron spectroscopy (XPS) technique is dramatically enhanced if combined with the x-ray standing wave (XSW) method. Full exploitation of this powerful combination requires hard x-rays. The exact lattice location of elements and chemical species identified by XPS can be determined without any a priori model. Furthermore, it is possible to evaluate in a direct way from which lattice site particular regions of the valence band spectrum of a crystal originate. This application was pioneered by J. Woicik and co-workers [1] and the obtained information is quite unique. In my talk I will briefly describe the principle of the XSW technique and discuss some recent applications underlining the above said. I will show how the structure of an ultra thin film of the 90 K superconductor $YBa_2Cu_3O_7$ on an oxide substrate can be retrieved and what we can learn about the growth mode of such a complex oxide. Furthermore, I will discuss how the valence band structure of $SrTiO_3$ can be disentangled and how the comparison with the calculated density of states yields unknown (solid state) cross section values for the $SrTiO_3$ valence band electrons. These experiments have been performed at ID32 at the ESRF and I will briefly comment on some other ongoing HAXPES activities at this beamline.

[1] J.C. Woicik, E.J. Nelson, P. Pianetta, PRL 84, 773 (2000).