High Energy-High Resolution Photoemission Spectroscopy from Solids

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PhotoEmission Spectroscopy (PES) is one of the most powerful tools to investigate solid state properties. The state of the art in high quality PES experiments can be summarized by an energy resolution of 5 – 30 meV for valence band spectra with hν < 40 eV, and of 30-200 meV at hν > 100 eV for core level spectra. A strong surface sensitivity, i.e. a few atomic layers, can be achieved by tuning the kinetic energy of photoelectron to the minimum of the so called 'universal curve' of escape depth. On the other hand, there is a lack of corresponding experimental information on truly bulk properties.
We report of PES experiments performed at ESRF (Beamline ID16), within the frame of the European VOLPE (VOLume PhotoEmission from solids) project, where we were able to achieve high energy resolution (71 meV at 5934 eV), as well as good statistics spectra up to 6-8 keV. We demonstrate that, at these kinetic energies, one may obtain information from >100 Angstrom of depth, corresponding to a maximum surface contribution **< 3-5** %.

We present recent results obtained on transition metals and highly correlated systems, and we discuss the relevant technical and scientific aspects of this new field of research.

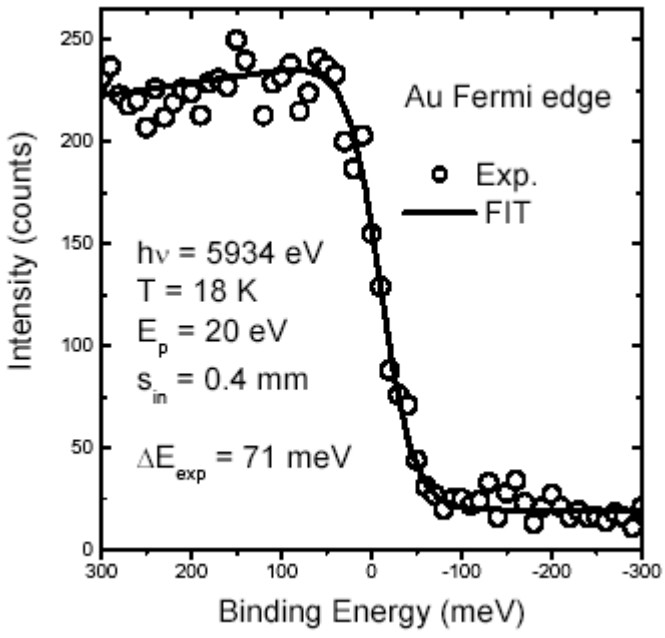

Fig. 1 Au Fermi level as measured at h_ =5933 eV and T = 18 K. The overall energy resolution as obtained from the fit of the Fermi edge, is about 71 meV (50 meV photons + 50 meV analyser).