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EMERGING PHOTOEMISSION TECHNIQUES FOR PROBING BURIED LAYERS AND INTERFACES: HAXPES, HARPES AND SWARPES

In this talk I will describe several new directions in the field of x-ray photoelectron spectroscopy, with a particular focus on the enhancement and control of depth sensitivity and selectivity of the measurement. Enhancement of depth sensitivity is achieved by going to higher photon energies with hard x-ray excitation and the resulting larger electron inelastic mean-free paths. This novel approach provides a more accurate picture of bulk electronic structure, when compared to the traditional soft x-ray photoelectron spectroscopy (XPS) which, for some systems, may be too strongly influenced by surface effects. I will present several case-studies wherein *hard x-ray photoelectron spectroscopy (HAXPES)* in multi-keV regime is used to probe the bulk properties of complex thin-film materials and heterojunctions, which would be otherwise impossible to investigate using conventional soft x-ray XPS. Furthermore, I will present the first results of *hard x-ray angle-resolved photoemission measurements (HARPES)*, at excitation energies of 3.24 and 5.95 keV. Compared to the traditional ARPES, carried out in the UPS regime (20-100 eV), this new technique enables one to probe on average 10-40 times deeper into the bulk. Finally, I will introduce a new photoemission technique *(SWARPES)* which combines soft x-ray ARPES with standing-wave (SW) excited photoelectron spectroscopy, wherein the intensity profile of the exciting x-ray radiation is tailored within the sample in order to provide a depth-selective probe of the electronic structure of buried layers and interfaces.