New features for the investigation of advanced materials by ESCA

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ESCA is an acronym for electron spectroscopy for chemical analysis, also known as X-ray photoelectron spectroscopy (XPS). This technique is able to provide important information on the chemical composition of the surface (<10 nm) in solid state materials. Together with Auger electron spectroscopy (AES) and ultraviolet electron spectroscopy (UPS), it is possible to obtain a full picture of the chemical-physical properties of the surface.

In this presentation will be illustrated special cases, where the combination of aforementioned techniques was employed to obtain information not only on the surface chemical composition, including the oxidation states of constituent elements, but also specific characteristics of materials. In particular, will be introduced the D parameter used for the determination of the carbon hybridization state (sp2 and/or sp3) in carbon-based materials, such as diamond-like carbon, carbon nanotubes, graphene, etc. Another important application is related to the determination of work function of metals and semiconductors by UPS. The cut-off energy can be determined in valence band spectra acquired by using He I ($h\nu$ = 21.2 eV) source. As a result, the work function is calculated by simple formula $wf = h\nu - BE_{cutoff}$. However, when the work function value of the sample is lower than the work function of the apparatus, it is calculated from the extrapolation by linear fit of the function BE_{cutoff} vs V1/2, acquired applying to the sample different bias values V.