The new generation of the hemispherical energy analyser in the novel surface science research

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Abstract: The complexity and the range of materials and their surfaces studied will be expanded across a wide range of topics, including surface science, catalysis, corrosion, semiconductors research, photoelectrochemical energy conversion, battery technology, or energy-saving technologies [1-5]. An unique and exceedingly flexible analysis cluster with a detection system is needed for these fundamental and applied research. Here it will be described a new energy and angle resolved analyser for photoelectron spectroscopy. The analyser has a hemisphere shape with a mean radius of 150 mm and is based on combining an advanced focusing electron lens system, which can be operated in different modes, transmission, spatial resolution or angular resolution. An angular resolution of better than 0.06° and spatial resolution 100 μm can be obtained. The spectrometer includes highly stable 6 kV power supply, where each independent voltage module achieves temperature stability below 0.5 ppm of the voltage span per degrees Celsius. The modern 2-D low noise CCD-MCP assembly with a noise level of < 0.01 cps/channel and a 70 fps fast camera are used. Fully automation and environmental software system make it a user-friendly tool for the conducted researches. The combination of the new generation hemispherical energy analyser with a liquid helium/nitrogen manipulators and modular PREVAC surface analysis system as part of multi-technique surface analysis systems will be presented, in order to permit complete characterization of the surface structure via XPS, UPS, ISS and APRES mapping. We will report the first results from this techniques, using analyser and induced by four interaction sources: X-ray, UV, electron or ion impact. Also the results of temperature dependent study on the metallic crystal will be presented. UV excited Xe5p spectra recorded in the gas phase show that the energy resolution is better than 3 meV at 2eV analyser pass energy. The application of the system will be shown on photovoltaic materials, graphene, or self-assembled organic monolayers of organic molecules. This analyser opens up new possibilities for angular/spatial resolved electron spectroscopy, band-mapping and other applications.

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