

Tools for ambient pressure XPS – development of high pressure energy analysers and X-ray monochromators

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Most of today's research on catalysis, corrosion, semiconductors, photoelectrochemical energy conversion, battery technology, or energy-saving technologies investigates the chemical composition and properties of surfaces [1-3]. Since a long time X-ray Photoelectron Spectroscopy (XPS) is considered as a powerful and versatile tool for surface characterization which is able to provide quantitative information about the elemental and chemical composition of surfaces.

However most of the important surface processes of interest in actual researches do not take place under UHV conditions needed for standard XPS instrument but in ambient conditions, high pressures or liquid environments. Hence results obtained under UHV conditions might be controversial for studying such surface processes.

In the last years, major efforts have been undertaken to close this pressure gap and to allow XPS measurements at more realistic process pressure.

Here we present first results of our analysing tools with energy analysers and X-ray monochromators for different pressure ranges, which are perfectly suitable for performing near-ambient pressure analysis.

The electron analysers, which are an evolution of the EA15 UHV energy analyser, are able to be operated at pressure up to 50 mbar. The energy and angle resolved hemispherical analysers with a mean radius of 150mm are equipped with a modern 2-D low noise CCD-MCP assembly.

Our new monochromatic source RMC50, which is able to work at elevated pressure, has a Rowland circle of 500mm diameter and is based on a single ellipsoidal quartz crystal. This monochromator can be used with an Al and Ag twin anode, which can be operated either in high power or small spot mode.

References:

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- [2] D. Silber et al., Nature Comm 7 (2016) 12888
- [3] S. Axnanda et al., Sci. Rep. 5 (2015) 9788