

Addressing properties of morphologically complex and nano-structured systems with synchrotron-based photoelectron microscopy

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The trend of modern nano-technology to invent complex nano-structured and composite materials with improved structural, chemical, electric, magnetic and optical properties has pushed the development and implementation of appropriate characterization methods exploring their structure, dynamics and function at proper spatial, temporal and energy scales. One of the important prerequisite for understanding dimensionality dependent phenomena is shedding light on the processes occurring at surfaces and interfaces where chemical specific imaging and micro-spectroscopy capabilities of Scanning PhotoElectron Microscopes (SPEM) and PhotoEmission Electron Microscopes (XPEEM) operated at synchrotron facilities have made important contributions [1]. The most recent achievements in shedding light on key factors controlling complexity at microscopic length scales will be illustrated with selected studies, (i) addressing properties of nanostructured and low dimensional matter as a function of composition, dimensions and ambient [2] and (ii) oxidation–reduction and mass transport events during surface reactions and at electrode/electrolyte interfaces of operating electrochemical cells [3]. Ongoing efforts for development and implementing of new set-ups that allow working closer to the realistic conditions will also be outlined and briefly discussed [4].

[1] S. Günther *et al*, Prog. Surf. Sci. 70, 2002, 187; A. Barinov *et al*, Nucl. Instr. Meth. Phys. Res. A, 601, 2009, 195; M. Amati *et al*, J. Electr. Spectr. Rel. Phenom. 224, 2018, 59 and references therein.

[2] A. Barinov *et al*, Adv. Mater. 21, 2009, 1916; Jabeen *et al*, Nano Res. 3, 2010, 706.

[3] A. Locatelli *et al*, Europ. J. Chemistry 12, 2006, 8890; M. Amati *et al*, Surf. Sci. 652, 2016, 20; B. Bozzini *et al*, Sci. Rep. DOI: 10.1038/srep02848; ACS Appl. Mater. Interf. 6, 2014, 6, 19621; Electrochem. Commun. 69, 2016, 50.

[4] A. Kolmakov *et al*, Topics in Catalysis 59, 2016 448 and references therein.