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UTILIZATION OF X-RAY RADIATION FOR SURFACE QUANTIFICATION OF ELEMENTAL AND CHEMICAL COMPOSITION OF OXIDE MATERIALS

Abstract

Oxide materials feature exceptional optical, electrical and magnetic properties, such as supra-conductivity at high temperatures, visible-light transparency, photocatalytic and super-hydrophilic ability, to mention just very few of them. Apart from basic interest, they are intensively studied nowadays in relation with energy- and environment applications, as well as key materials in micro-electronics, bio-materials and space. The advance in their study is connected with the progress in

materials science, but also with tremendous achievements in instrumentation and characterization procedures introduced after the 7-th decade of the last century [1].

Exploitation of the benefits of semiconductor oxide materials cannot be ensured with-out proper understanding and adjustments of their band structure in connection with surface/interface transport processes, morphology, structure, elemental and chemical composition. A number of surface/interface quantification techniques have been proposed and documented allowing for elemental and chemical quantitative analysis, as well as for measuring crystallinity, optical transmittance, specific surface/interface energy, which resulted in innovative solutions for mass production.

Details will be given in the current presentation on the implementation of the most widespread surface quantification approaches. Special attention is paid to the specificity in characterization of a class of oxide materials – TiO2, WO3, ZnO – either as thin films or 1D nanostructures.

Results of own systematic studies will be discussed for pristine and doped materials [2–4], as well as in bi-layer configurations [5]. By using ESCA/XPS and Auger electron spectros-copies, improvements in photo-catalytic quantum yield and activation time, surface wettability and in optical parameters were correlated with films crystallinity, electronic structure, defect density in the surface region and other materials' characteristics.

The results are significant in designing devices for photocatalytic, TCO and micro-fluidics applications.

Literature

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