MS23-P6 Structural characterization of quantum dot lattices by GISAXS: models and software package *GisaxStudio*

Maja Buljan[1], Igor Mekterović[2], Marko Karlušić[1], Iva Bogdanović-Radović[1], Darko Mekterović[3], Marko Jerčinović[1], Sigrid Bernstorff[4], Nikola Radić[1], Vaclav Holy[5]

1. Ruđer Bošković Institute, Bijenička cesta 54, 10000 Zagreb, Croatia
2. Faculty of Electrical Engineering and Computing, 10000 Zagreb, Croatia
3. University of Rijeka, Department of Physics, Radmile Matejčić 2, 51000 Rijeka, Croatia
4. Elettra-Sincrotrone Trieste, SS 14 km 163.5, 34149 Basovizza, Italy
5. Charles University in Prague, Prague, Czech Republic

email: mbuljan@irb.hr

We present models for structural characterization of nanostructured materials consisting of different quantum dot lattices by GISAXS (grazing incidence small angle x-ray scattering). They enable the determination of the shape and arrangement properties of the formed nano-objects as well as their statistical distributions. The developed models are incorporated in a new program *GisaxStudio*. It contains two families of models: -*3dLattice* for the analysis of three-dimensional quantum dot lattices formed by different self-assembly processes and -*iBeaM* which is suitable for the analysis of GISAXS intensity distributions measured on ion-beam modified materials.

GisaxStudio is a modular, multi-platform program for GISAXS analysis of various nanostructured materials. It is written in Java programming language, featuring a graphical user interface, built-in optimization algorithms and visualization. It stores all data in the relational database which facilitates data exchange and reproducibility. It is free for non-commercial use and can be downloaded from the http://homer.zpr.fer.hr/gisaxstudio.

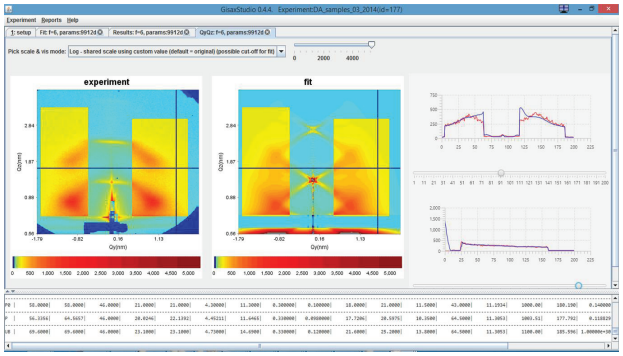

Figure 1. One of the windows of the program *GisaxStudio* showing the experimental and simulated GISAXS maps.

Keywords: GISAXS, GisaxStudio, Program, Quantum dot lattices

MS23-P7 Synthesis of carbon nano-onion/nickel hydroxide/oxide composites for electrochemical supercapacitor electrode applications

Marta E. Plonska-Brzezinska[1], Diana Brus[1], Krzysztof Brzezinski[1], Luis Echegoyen[2]

1. Institute of Chemistry, University of Bialystok, Hurtowa 1, 15-399 Bialystok, Poland
2. Department of Chemistry, University of Texas at El Paso, 500 W. University Ave., El Paso, TX 79968, USA

email: mplonska@uwb.edu.pl

The high temperature annealing of ultra-dispersed nanodiamonds (5 nm, average size) leads to their transformation into CNO structures (5-6 nm in diameter, 6-8 shells), that can be also described as multi-shelled fullerenes. The interest in carbon nano-onions is driven by their unusual physico-chemical properties as well as by promising applications in electronics, optics, and in energy conversion and storage. In electrical double layer capacitors (EDLCs) the energy can be stored via ion adsorption and the capacitance is associated with an electrode-potential-dependent accumulation of charge at the electrode interface through polarization. During the charging/discharging process of carbon-based EDLCs, the electrode material is not electrochemically active. In pseudocapacitors the electrode material is electrochemically active and faradaic reactions take place. The type of charge storage mechanism determines the electrochemical performance of EDLCs and the electrode materials are also crucial. New types of supercapacitors which combine the advantages of both double layer capacitors and pseudocapacitors are the subject of this work. Carbon nano-onion (CNO) and $Ni(OH)_2$ or NiO composites were prepared by a simple method, which is based on chemical loading of $Ni(OH)_2$ on the carbon surface. The electrochemical properties of the resulting composites were studied to investigate their potential as supercapacitors. The samples were characterized by transmission and scanning electron microscopic methods, powder diffraction techniques and by differential-thermogravimetric analyses. Textural properties were characterized using nitrogen gas adsorption analyses. Pristine inorganic samples of NiO and $Ni(OH)_2$ revealed different morphologies and porous characteristics when compared to those of the CNO composites, which showed unique electrochemical properties. The electrochemical performance of the CNO/$Ni(OH)_2$ or CNO/NiO composites is largely affected by the mass, the morphology and distribution of the $Ni(OH)_2$/NiO phase. The electrochemical properties of these electrodes were investigated using cyclic voltammetric and electrochemical impedance spectroscopic analyses. Compared with pristine CNOs (40 F/g), modified CNOs with the inorganic components show improved electrochemical performance (ca. 1125 F/g for CNOs/$Ni(OH)_2$ and ca. 370 F/g for CNOs/NiO).

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Keywords: carbon nano-onion, composite, supercapacitor, capacitance