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Keywords: nickel_oxide, nanocrystal, powder_diffraction

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Crystallographical characterization of nanocrystals PbS doped with Ni

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The thin films of lead sulfide (PbS) doped with Ni have been successfully synthesized using chemical bath deposition (CBD) method. The films were deposited on glass substrate at temperature 80 ± ± 2 °C, using five different levels of doping Ni; 0, 2, 4, 6, 8, and 10 mLs. The structural characterization shows that the films are deposited on phase face-centered cubic and the decreases in grain size (TG) with increases of Ni concentration, from order 40 to 10 nm.

Keywords: crystallographical, nanocrystals, PbS

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X-ray scattering studies of amorphous and nanocrystalline pharmaceutical materials

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The increased interest in recent years regarding the properties and applications of amorphous and nanocrystalline materials has also created the need to characterize the structures of these materials. However, due to the lack of long-range atomic ordering, the structures of nanostructured and amorphous materials are not accessible by conventional diffraction methods used to study crystalline materials. One of the most promising techniques to study nanostructures using X-ray diffraction is by using the total scattering (Bragg peaks and diffuse scattering) from the samples and the pair distribution function (PDF) analysis. The pair distribution function provides the probability of finding atoms separated by a certain distance. This function is not direction-dependent; it only looks at the absolute value of the distance between the nearest neighbors, the next nearest neighbors and so on. The method can therefore also be used to analyze non-crystalline materials. From experimental point of view a typical PDF analysis requires the use of intense high-energy X-ray radiation (E ≥ 15 KeV) and a wide 2θ range.

In this study we present PDF results obtained from several pharmaceutical materials (salbutamol sulfate, sulfamerazine and paracetamol) and discuss the applicability of the PDF analysis for structural characterization of amorphous and nanocrystalline materials with application in the pharmaceutical industry. The experimental results presented in the poster were obtained using a standard laboratory X-ray diffraction system.

This study further demonstrates that PDF analysis with a laboratory diffractometer can be a valuable tool for structural characterization of nanomaterials.

Keywords: amorphous, nanocrystal, pharmaceutical

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A new method for measuring x-ray rocking curves by means of x-ray acoustooptics

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A new method for measuring angular distribution of X-ray beam diffraction intensity (method for measuring X-Ray rocking curves) is represented. Intensity distribution analysis in this method is conducted by ultrasonic modulation of a lattice parameter of X-ray acoustic crystal, used as an analyzer. The distinctive feature of this method is the possibility to lead precise and time-resolved measurements of X-ray rocking curves without using sophisticated goniometry system.

Special X-ray acoustooptics elements – X-ray acoustic resonators, consisting of a piezoelectric crystal (quartz) and X-ray optical crystal (silicone) was developed to implement the method. Piezoelectric crystal was used to create a standing acoustic wave and control effectively a tension-compression deformation in the X-ray optical crystal [1]. Developed X-ray optical scheme and optical elements allow us to create uniform (within X-ray beam footprint) time-variable deformation of crystal lattice [2] and use these X-ray acoustic resonators as analyzers of scattered X-rays beam.

Rocking curves, measured by proposed X-ray acoustic method by shape and halfwidth agrees well to curves measured according to traditional way - by rotating a crystal. Experimental results of method approbation - examples of rocking curves of (440) reflection silicon crystal and (220) paratellurite crystals measured on laboratory diffractometer using X-ray acoustic method will be presented. Fig.1. shows an X-ray optical scheme and DuMond diagram corresponding to this double-crystal scheme.

The angular and time resolution of the method is determined by speed of detecting apparatus (the minimum possible changing of phase and minimal width of stroboscopic window or number of channels of the multichannel scaler) and depends on parameters such as ultrasound frequency and amplitude of ultrasonic vibrations. Experimentally achieved resolution of the method is 0.1 arcsec. Accuracy can be increased no less than an order by using an ultra-fast multichannel scaler. Developed method and experimental schemes are totally applicable for synchrotron radiation conditions.

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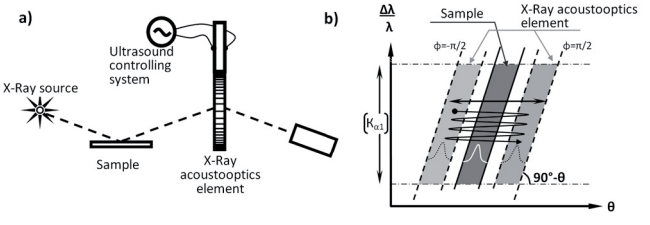

Fig.1 Experimental X-Ray optical scheme (a) and DuMond diagram (b) illustrated approach to measure rocking curves.