



**Immanuel Kant  
Baltic Federal  
University**

**Functional  
Nanomaterials**

Immanuel Kant Baltic federal university  
Research and education center «Functional Nanomaterials»

# **Book of abstracts**

## **International Baltic School on solid state and magnetism phenomena**

Svetlogorsk, Kaliningrad  
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# ***International Baltic School on solid state and magnetism phenomena***

*(Svetlogorsk, Kaliningrad, August 11-18<sup>th</sup>, 2012)*

The primary aim of the School is to bring together young students and experienced and distinguished scientists to give them an opportunity to discuss the recent trends in the investigation of solid state materials. The program of the Baltic School will comprise Plenary Lectures from leading experts and the Student's poster presentations.

## ***Contributors to MISM 2011:***

- \* Immanuel Kant Baltic federal university
- \* Russian foundation for basic research

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# THE STUDY OF STRUCTURAL CHANGES IN AMORPHOUS C<sub>60</sub> : TEMPERATURE AND THERMOBARIC EFFECTS

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The high-temperature annealing of amorphous (fine-grained) fullerites prepared by the mechanical activation of crystalline C<sub>60</sub>, is accompanied by a polyamorphous phase transition from the amorphous molecular phase to the amorphous atomic phase. The latter is much more thermostable than the initial crystalline fullerite C<sub>60</sub>. The aim of this paper is to study the effect of temperature and thermobaric effects on amorphous C<sub>60</sub>.

Samples of amorphous fullerites C<sub>60</sub> have been obtained by mechanical activation (grinding in a ball mill). The structure of the samples has been investigated by neutron and X-ray diffraction. The high-temperature (up to 1200 °C) annealing of amorphous fullerites revealed a polyamorphous transition from molecular to atomic glass, which is accompanied by the disappearance of fullerene halos at small scattering angles. Possible structural versions of the high-temperature amorphous phase are discussed. After thermobaric and temperature effects structure of amorphous fullerite are different.

It was established that the transition in nanostructures occurs between stable states (amorphous fullerite and amorphous graphite) through intermediate amorphous phases.

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## HYDROXYAPATITE OH-CHANNELS FOR PROTON TRANSFERRING AIMED TO SURFACE CHARGING

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HAP is one of the most widely used materials in contemporary nanobiomedicine and nanotechnology. The interaction between HAP based biomaterials and living cells is improved, if the HAP surface is charged electrically [1, 2]. The charge is inducible on HAP structures by the proton

transport along the OH chains in columnar channels. These chains are formed by OH ions along c-axis and are surrounded by calcium triangles.

The results of computing simulation and studying of hydroxyapatite (HAP) properties and its hydrogen bonds and proton transfer peculiarities, surface and polarization properties [1] are presented. The reported data presents as *ab initio* quantum-chemical calculations (with Gaussian98 code, HF, 6-31G(d)), as well semi-empirical (PM3) and DFT by HyperChem 8.0, which clarify the double-well asymmetric potential energy profile and were held to investigate the energy barriers for proton transport along the columnar channel. The calculated values of barriers can explain long storage of polarization charge, which is observed in experiments, as electrets effect. A possibility to transfer proton via the barrier is supported due to the experiment. High pressure of hydrogen and followed electromagnetic stimulation induced transfer of the proton. In fact, the electron work function was altered for different kind of ceramics.

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References:

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2. Yu. Dekhtyar, V. Bystrov, I. Khlusov, N. Polyaka, R. Sammons and F.Tyulkin. - In: *The Society for Biomaterials 2011 Annual Meeting.* - April 13 - 16, 2011, Orlando, Florida, USA.

## **ULTRAFAST DYNAMICS OF MAGNETO-OPTICAL KERR EFFECT IN MAGNETOPLASMONIC CRYSTALS**

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The possibility to study ultrafast processes appeared with the invention of lasers with pulse duration of few hundreds of femtoseconds. One of such processes is resonant excitation of collective oscillations of light and electrons – surface plasmon-polaritons (SPP's). The lifetime of this process in the optical interval of the electromagnetic spectrum usually does not exceed a sub-picosecond range. One of the possibilities is to excite SPP's with the use of periodic nanostructured metallic films. The periodicity leads to the appearance of the band structure in the SPP dispersion law and such nanostructures are known as plasmonic crystals. The dependence of the SPP lifetime on the excitation conditions leads to the possibility of shaping of the femtosecond pulses reflected or transmitted