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Phase equilibrium and size-effects in glass ceramic containing copper chloride nanocrystals

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Copper chloride nanocrystals in potassium aluminoborate and sodium borosilicate glass matrices were studied by small-angle X-ray scattering (SAXS) technique. Copper chloride emerges from initial glass during thermal treatment in drops of liquid. The drop sizes and hence the sizes of crystals after cooling depend on the temperature and treatment duration. The crystal size range is 1-50 nm.

SAXS technique allows phase transitions of CuCl to be studied. During the cooling process, the halide phase reaches the supercooled liquid state crystallizing at a temperature considerably lower than that of the solidus. The size dependence of phase transition temperatures was determined, the less the crystal (drop) sizes the lower the temperatures of phase transitions.

The X-ray diffraction analysis revealed the presence of hexagonal modification of CuCl nanocrystals at room temperature, while hexagonal modification of CuCl in macroscopic systems has only been found to exist above 407°C. It was found that using different variants of thermal treatment, it is possible to obtain samples with different content of cubic and hexagonal nanocrystals, to achieve complete dissolution of hexagonal crystals or, by quenching, to get amorphous phase.

Biography

Petr Onushchenko graduated with Master Degree in Physics from Saint-Petersburg State University in 2011. Now he is a junior researcher at Institute of Silicate Chemistry of Russian Academy of Sciences, Department of Glass Structure and Properties. He studies the glass structure using small-angle X-ray scattering methods. He was awarded twice at Young Scientists Conference of Institute Silicate Chemistry of RAS in 2011 and 2012. He already has 5 papers published in *Russian Journal of Glass Physics and Chemistry.*

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Electrical and magnetic properties of chitosan-starch films reinforced with magnetite-decorated MWCNT's

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Carbon nanotubes (CNT's) have gained much attention because their unique physical and chemical properties. Magnetite nanoparticles also exhibit extraordinary properties. Their magnetic properties and their nanostructure control allowed by the synthesis process such as co-precipitation, make this material very attractive for nanocomposites preparation. Nowadays, multifunctional composites with electrical and magnetic properties for potential biomedical applications are developed by linking these nanomaterials to a biocompatible polymeric matrix. However, the use of CNT's is limited due to their reduced solubility, bundling and agglomeration tendency. Chitosan is a biopolymer that has been reported to solubilize carbon nanotubes. Starch is also a biopolymer used to improve the carbon nanotubes hydrophilicity which results in well disperse and more stable composite materials. CNT's are capable of interacting with magnetite nanoparticles. Based on this, chitosan-starch films reinforced with magnetite decorated multiwall carbon nanotubes (MWCNT's) were prepared to create well dispersed multifunctional nanocomposite materials which their electrical and magnetic properties are studied in this work. MWCNT's were decorated with magnetite nanoparticles of 13.45 ± 3.73 nm. MWCNT/Magnetite nanoparticles ratios of 1.3 and 2 were used. The polymeric matrix was formed of 70 % of chitosan and 30% of starch. Concentrations of magnetite decorated CNT in the films varied from 0.1%, to 0.5%. The electric conductivity of the films was found to increase when the decorated MWCNT's content increases. The magnetization behavior change from superparamagnetic to ferromagnetic according the magnetite-MWCNT's content.

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