Nanocomposites and nanomaterials

Structure and optical properties of metal alkanoates with semiconductor and metal nanoparticles

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Structural and optical properties of nanocomposites based on metal alkanoates with Au and CdS, CdSe nanoparicles have been studied. Last years, metal alkanoates successfully used as nanoreactors for synthesis and stabilization of metal and semiconductor nanoparticles [1,2]. Nanoparticles Au and CdS, CdSe are chemically synthesized in thermotropic ionic liquid crystalline phase of cadmium (or cobalt) octanoate matrix.

Nanocomposites based on metal alkanoates can form thermotropic ionic liquid crystals, that is Smectic A, with a temperature range of mesophase T_m = 100 – 200^0C. It was found, that nanocomposites keep the same liquid crystal ordering after being cooled to the room temperature. In this case, it forms ionic smectic glass. Nanocomposites in different phases: polycrystalline powder of synthesized nanocomposites, Smectic A phase, and anisotropic glasses were considered by small-angle X-ray technique. Structural peculiarities of nanocomposites were characterized also by absorption spectroscopy and transmission electron microscopy (TEM). Based on the X-ray data it was established that the synthesized nanoparticles do not violate the bilayer structure of matrix.

The optical properties of gold nanoparticles have been analyzed by considering the surface Plasmon resonance, which is one of the most interesting dynamic properties of metal as dimension become confined. The average size of spherical Au nanoparicles was estimated as about 20 nm.

Interestingly, there is another aspect. Gold nanoparticles were synthesized in two different matrices: cobalt octanoate matrix absorbs of light in the visible wavelength range, but cadmium octanoate does not absorb. Therefore the impact of such matrices on the optical properties has been analyzed.