Nanocomposites and nanomaterials

Method of fabrication of thin-film opal coating

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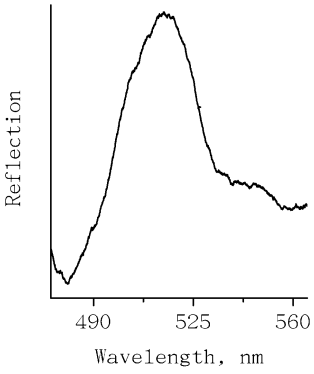
Development of new methods of two-dimensional crystallization of monodisperse silica spheres on a hard, flat hydrophilic substrate is an important problem of creating opal structures. The purpose of such methods is to fabricate optically homogeneous film coatings with photonic crystal properties [1].
The present work is devoted to developing of a fabrication method high-quality opal films with the area not less than 0.1 m^2 as well as measurement of their reflection spectra.
Monodisperse silica globules with a diameter of 270 nm were synthesized by a modified Stober's method [2]. Spraying of colloidal particles on a optical quality horizontal substrate was carried out with an airbrush Intertool PT-1504. The flow of suspension near the substrate consisted of fine droplets of a size less than 100 microns. The uniform layer was formed by suspension droplets interacting with the substrate. To increase wettability of the substrate surface the ethyl alcohol was added to a suspension. It promotes formation of optically homogeneous layer during the slow drying of the coating. Formation of regular layer was provided due to the balance of surface tension forces of suspension and repulsion of negativly charged globules. Fabricated films had a thickness of about 5 micron and had noticeable high uniformity iridescence. The presence of an regular structure is demonstrated by the measured of reflection spectrum for angle of incidence $\theta = 30^0$ (see figure).



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1. *Kalinin D.V., Serdobinceva V.V., Shabanov V.F.* // Russian Nanotechnologies. - 2009, -4, N 5-6, -P. 131-137 (in Russian).
2. *Stober W., Fink A., Bohn E.* // J. Coll. Interf. Sci. - 1968, -26, -P. 62.