Nanocomposites and nanomaterials

Formation and Raman characterization of nanocrystalline phase Bi_2TeO_5 in the pores of synthetic opals

V.N. Moiseyenko[1], M.P. Dergachov[1], B. Abu Sal[2], R. Holze[3], N. Brynza[1]

[1] *Physics, Electronics and Computer Systems Department, Oles Honchar Dnipropetrovsk National University. Prospect Gagarina, 72, Dnipropetrovsk-49010, Ukraine.*
E-mail: vnmois@yandex.ru

[2] *Applied Physics Department, Faculty of Science, Tafila Technical University P.O. Box 40, Al-Eis 66141, Tafila, Jordan*

[3] *Technische Universität Chemnitz, Institute of Chemistry, AG Elektrochemie, Strasse derNationen 62, D-09111 Chemnitz, Germany*

This work deals with the creation and Raman characterization of new nanostructured materials based on synthetic opals and photorefractive material for holographic data storage Bi_2TeO_5 (BTO) [1].
Filling the pores of opal samples was carried out by impregnating the melt of the single crystal Bi_2TeO_5 under the influence of capillary forces. The fact of incorporation of the BTO into the opal pores was inferred from the shift of the maximum of the Bragg reflection band to longer wavelengths due to the increase in ε_{eff}. The degree of filling of the pores of opal with BTO, calculated from the shift of the maximum value λ_m reflection peak using Bragg's law was ~ 85 vol. %. For additional checking of the substance in the pores of the opal, we measured spectra of infrared transmittance from 400 cm^{-1} to 1500 cm^{-1}. Typical absorption bands of the of the opal matrix at frequencies 484 cm^{-1}, 620 cm^{-1}, 756 cm^{-1}, 789 cm^{-1}, 984 cm^{-1}, 1056 cm^{-1}, 1091 cm^{-1} and weak BTO band at 882 cm^{-1} were observed.

The measured Raman spectra enabled identification of the substance in the pores of opal and set its crystalline state. Changes in the Raman spectra of composite opal - Bi_2TeO_5 compared with the spectra of the corresponding polycrystalline powders and single crystals can be caused by a change in the bond lengths Bi-O and Te-O after nano crystallization in the pores of the opal as well as the formation of new bonds and structures at the interface melt - surface SiO_2 globules.

1. *Horn W., Földvari I., and Denz C.* Holographic data storage in photorefractive bismuth tellurite // J. Phys. D: Appl. Phys.-2008.-**41.-**P.224006 (9pp).