Nanooptics and nanophotonics

Low-frequency Raman scattering in nanoscale films of tin dioxide structured by polymers

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Chemical and electrophysical properties of tin dioxide in the nanocrystalline state strongly depend on the particle size. As the Raman spectroscopy is one of the most sensitive methods for the materials science investigations, hence the nanosized tin dioxide being studied by this method gave plenty of information, especially in the field of its application in electronics. The present work comprises the results on the RS in nanosize tin dioxide films, structured by polymers [1].

The resulting RS spectra for the low-frequency region of the nanoscopic SnO_2 layers are not fully legible and asymmetrical. The peaks broadening and their asymmetry may, similar to other researchers, also be the result of selection rules violations for nanocrystalline objects due to the considerable number of surface atoms contribution to the Raman spectra. The surface morphology studies showed the nanoclusters presence in the films. This also allows one to connect the asymmetry in the Raman spectra with size effects and to comment it in the frames of the spatial phonons confinement.

In the range of up to 100 cm^{-1} the vibration mode was registered at 25 cm^{-1} (Stokes region), and in the anti-Stokes region - at 34.9 cm^{-1}. The same peak was registered also in [2] where it was connected with the normal vibrations of SnO_2 nanorods. Consequently, also in our case, this peak may be considered as a vibration of nanoparticle as a whole.

The interval 100-200 cm^{-1} contains three types phonons scattering peaks, and at the same time have the noticeable absence of symmetry in the bands' positions: 97.78, 115.5, 166.7 cm^{-1} (Stokes region) and in corresponding them anti-Stokes 102.3, 112.39, 165.2 cm^{-1}. Two of the pointed bands are registered in [2]. The band 115,5 (112,39) cm^{-1}, evidently corresponds to the classical SnO_2 B_{1g}, mode. The band 166,7 (165,2) cm^{-1} is close to the circumnuclear mode 157,9 cm^{-1}, which is also detected in [2]. Such type asymmetry was observed also in [2] where RS in nanoscopic rods of tin dioxide was connected with the dimensional limitations in two directions, which is applicable to our results.

1. *Filevskaya LN, Smyntyna VA, Grinevich VS* Morphology of nanostructured SnO_2 films prepared with polymers employment // Photoelectronics.- 2006.- 15.- P. 11-14.
2. *Y.-K. Liu, Y. Dong, G.H. Wang*, Low frequency and abnormal Raman spectrum

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