Nanocomposites and nanomaterials

The temperature dependent studies of Luminescent in nanosized SnO_2 films

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Tin dioxide, widely used in various electronics industries, is not a luminophore material, however, the luminescence of crystalline dioxide at low temperatures is described in the literature [1]. Nanoscale forms of this material have recently been increasingly described as luminescent, which expands the possibilities of its use [2].

The paper presents the results of temperature studies of the luminescence of nanoscale tin dioxide films obtained by a sol-gel method using polymers in the 9-300 K range.

SnO_2 films obtained using polymers exhibited photoluminescence at room temperature in the orange-red region of the spectrum. Two peaks are observed in the photoluminescence spectra: the first in the region 1.85-1.9 eV and the second in the region of 2.32 eV. Apparently, the peak at 647 nm (1.9 eV) is associated with oxygen vacancies in the samples studied, and in the region of 2.32 eV with excess tin. The temperature dependences of the peak energy, their intensity and half-width are considered.

The temperature dependences show a significant decrease in the luminescence intensity of the peaks with increasing temperature. The observed effect is explained by the temperature quenching of luminescence as a result of nonradiative recombination. This is a consequence of the existence of a significant density of electron states at the edges of the forbidden band, specific for in dioxide, especially for nanoscale thin films with a significant disruption of long-range order.

The temperature dependences of the half-width of both luminescence bands show an almost jump-like growth in the region 180-200 K, which is more pronounced for peak 1. This indicates the participation of optical phonons in the luminescence, which are usually not active at low temperatures (up to 200 K)

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