Nanocomposites and nanomaterials

Photoactivity of nanostructured TiO_2/MnO_x composites. Spectroscopic studies

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The mixed titanium-manganese oxides, TiO_2/MnO_x (TMO) have enhanced photoactivity in response to the light and are attractive materials for photosensory, photocatalytic and photovoltaic applications. In this work we studied the nanostructured anatase and rutile-based TMO composites with different Mn contents. High-purity TMOs were synthesized by chemical deposition of manganese hydroxides on the surface of TiO_2 particles, followed by thermal treatment at different temperatures. The samples were characterized by proven XRD, FTIR, FT-Raman, UV-VIS optical absorption and PL emission spectroscopy methods [1]. According to XRD, nanocrystalline TMOs, calcined at 300^oC, have Mn_2O_3 phase, while TMOs annealed at 1000^oC have the $MnTiO_3$ phase. FT-Raman spectra show the existence of different transient MnO_x crystal phases and their transformation due to the thermal treatment. FTIR spectra of TMO observed in the region of internal and lattice vibrations (400-800 cm^{-1}) of TiO_2, Mn_2O_3 and $MnTiO_3$ suggest the existence of different oxidation levels and structural defects. UV-VIS absorption spectra show a significant shift of the absorption edge toward longer wavelengths. This implies a reduction in the band gap as compared with pure TiO_2. For TMO with Mn of 15at.% the *E*a value is of 2.4 eV. PL spectra of TMO are almost similar to those of TiO_2, while their intensities differ. At higher Mn content, due to the increasing number of non-radiative recombination centers, the PL intensity is lower. These results demonstrate the potential use of TMO.

1. *Kernazhitsky L., Shymanovska V., Gavrilko T., Naumov V., Fedorenko L., Kshnyakin V., Baran J.* Room temperature photoluminescence of anatase and rutileTiO_2 powders // J Lumin.-2014.-**146.-**P. 199-204.