Nanocomposites and nanomaterials

Sorption and photocatalytic properties of TiO_2/CdS nanocomposites

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Titanium(IV) oxide (TiO_2) is most popular photocatalyst due to its high photocatalytic activity, chemical stability, low cost and toxicity. However, photocatalysis on titanium (IV) oxide has some significant drawbacks. Bandgap of titanium(IV) oxide is 3,2÷3,5 eV, so light absorption by titanium(IV) oxide in the UV region of the spectrum. The efficiency of photocatalytic process can be increased by creation of nanocomposites on its basis and other semiconductors with smaller bandgap than TiO_2. Accordingly, creation of nanocomposites based on titanium(IV) oxide and cadmium sulfide would allow reducing bandgap and, therefore, increasing activity in the visible light [1].

Synthesis of nanocomposites was carried out as follows. Aqueous solutions of sodium thiosulfate and cadmium nitrate mixed, and then was added cetyl-3-metylammonium bromide (CTAB). Titanium(IV) chloride slowly added in the bulk solution and heated, evaporated of water, and precipitate calcined. Thus was obtained 5 samples with different content of CdS in nanocomposites: 0.0; 0.5; 2.0; 4.0; 7.0 wt%, accordingly. These samples had the following composition (by X-ray analysis): 100% rutile (0.0% CdS); 100% rutile (0.5% CdS); 74% rutile and 26% anatase (2.0% CdS); 42% rutile, 56.5% anatase and 1.5% CdS (4.0% CdS); 35% rutile, 62% anatase and 3% CdS (7.0% CdS). The calculated bandgap (on transmission spectra) for these nanocomposites made 3.52; 3.49; 3.45; 3.44; 3.43 eV, accordingly.

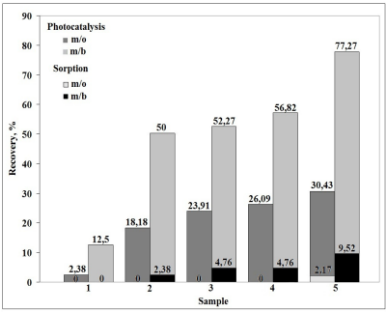

Figure – Sorption and photocatalytic properties of synthesized nanocomposite samples

As show on Figure, adsorption and photocatalytic recovery of methyl orange and methylene blue increases with increasing content of CdS in the nanocomposites. This is consistent with the data of X-ray diffraction analysis and calculated bandgap (increases content of anatase modification and decreases bandgap of nanocomposites with rising CdS).

1. *Vinu R., Madras G.* Environmental remediation by Photocatalysis // Journal of the «Indian Institute of Science».-2010.-**90**, N 2.-P. 191-192.