

NANOCOMPOSITES OF THREE SEMICONDUCTORS AND THEIR PHOTOCATALYTIC ACTIVITY IN TOLUENE DEGRADATION

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One of the main trend in photocatalysis is to develop nanomaterials which can be combinations of three different semiconductors depending on their band gaps positions. The third generations materials provide an opportunity for multi(two)-photon excitation of photoactive materials with lower energy photons and utilization of heterojunction to drive electronic processes in the desired direction (Fig. 1). Consequently the selective photoexcitation of localized electronic states to gain better selectivity should be achieved [1]. The photocatalysts activated by low powered and low cost irradiation sources (such as LEDs or black fluorescent UV lamps) can be used in air and water purification systems.

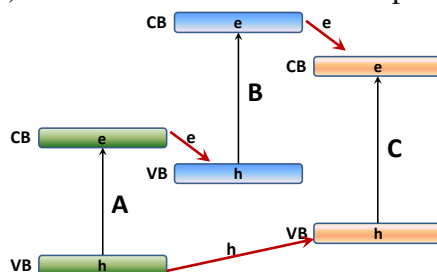
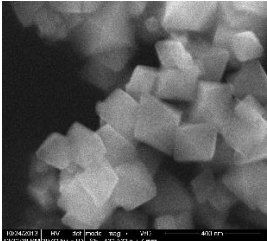
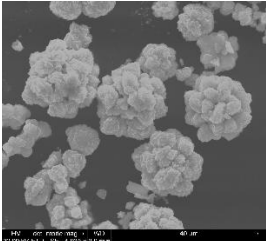
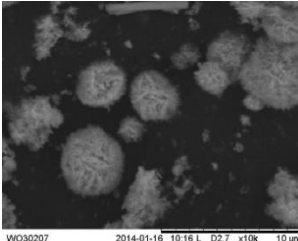


FIGURE 1. The mechanism of excitation in three components nanostructures according to Serpone's theory [1]

The photocatalysts combinations were selected according to Serpone's theory (Fig. 1). The nanomaterials (as shown in Table 1) were prepared *via* hydrothermal methods in stainless-steel autoclave under room temperature and appropriate pressure. The synthesis conditions were chosen depending on the nanocomposites configurations.

TABLE 1. Combinations of semiconductors and their electronic properties according to Serpone's theory

Semiconductor A KTaO ₃			Semiconductor B CdS			Semiconductor C WO ₃		
			Band gap (eV)	VB position (V)	CB position (V)	Band gap (eV)	VB position (V)	CB position (V)
3.4	3.1	-0.3	2.4	1.8	-0.6	2.8	3	0.2

VB – valence band, CB – conduction band

References:

[1] Serpone N., Emmeline A.V., J. Phys. Chem. Lett. 3 (2012) 673-677.

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