

Nanocomposites and nanomaterials

Comparison of photocatalytic properties ZnO nanorods fabricated by different methods

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Wastewater treatment from organic impurities remains the most important task of water resources recovery. A promising method of water purification from organic dyes is photocatalysis with semiconductor materials. Catalysts based on ZnO are low cost, stable, non-toxic and do not require reactivation.

ZnO nanorods were grown on the silicon (001) substrates by two different methods. The photocatalytic properties of as grown and Ar-ion-treated ZnO materials were tested using photocatalytic degradation of an aqueous solution of methyl orange (MO) dye serving as a model water contaminant. The reaction rate constants calculated using the first-order approximation were equal to $5.3 \cdot 10^{-5} \text{ s}^{-1}$ and $3.7 \cdot 10^{-4} \text{ s}^{-1}$ for as grown ZnO nanorods produced by gas-transport reactions and hydrothermal method, respectively. After a brief treatment of samples surface by argon ions the reaction rate constant values increased to $1.85 \cdot 10^{-4} \text{ s}^{-1}$ and $5.9 \cdot 10^{-4} \text{ s}^{-1}$, respectively. Based on the analysis of the photoluminescence spectra, it is assumed that the differences in photocatalytic activity are due to the predominance of various types defects on the surfaces of ZnO nanorods grown by the methods of the gas-transport reactions [1] and the hydrothermal [2]. The experimental results show that ZnO nanostructures grown by the hydrothermal method would be promising for producing efficient catalysts.

1. *Kapustianyk V., Turko B., Rudyk V., Rudyk Y., Rudko M., Panasiuk M., Serkiz R.* Effect of vacuumization on the photoluminescence and photoresponse decay of the zinc oxide nanostructures grown by different methods // *Opt Mater.*-2016.-**56**.-P. 71-74.

2. *Bhavsar K., Ross D., Prabhu R., Pollard P.* LED-controlled tuning of ZnO nanowires' wettability for biosensing applications // *Nano Rev.*-2015.-**6**.-P. 26711-26717.