

Effect of copper sulfate concentration in growth solution on photocatalytic properties of ZnO/CuO nanostructures

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Metal oxide semiconductors are the most suitable materials used for photocatalytic processes in industry and the environment (in particular, they are involved in wastewater decontamination processes). Semiconductors are relatively inexpensive, safe for health, chemically stable, and have high photosensitivity [1, 2]. One of the most challenging tasks at present is to improve the photocatalytic activity of photocatalysts for practical applications in the visible range, namely, high energy transfer efficiency, non-toxicity and low cost. The main efforts in the field of photocatalysis are devoted to the modification of existing photocatalysts to increase their photocatalytic characteristics [3]. In this work, semiconductor composites of copper (II) oxide and zinc oxide (ZnO/CuO) were synthesized using a low-cost method.

To study the effect of the concentration of copper sulfate in the growth solution on the photocatalytic properties ZnO/CuO nanocomposites were synthesized by a low-temperature hydrothermal method. The aqueous solution contained copper sulfate, zinc chloride, and sodium hydroxide. A series of samples with different concentrations of copper sulfate (0.7 mmol - 2.0 mmol) was considered.

The results of studying of the synthesized samples by electron microscopy showed that the obtained ZnO/CuO nanocomposites consist of thin filamentary ZnO rods with CuO nanoparticles attached to them. It was noted that an increase in the copper sulfate concentration in the growth solution to 2.0 mmol with the remaining parameters unchanged leads to an insignificant change in morphology: the volume of flocculent structures and the amount of CuO nanoparticles increase.

Samples of the RhB solution for measuring of the optical density spectra were carried out every 30 minutes for 150 minutes. It should be noted, that with the used the same parameters for the ZnO/CuO powders synthesis, an increase in the amount of CuO nanoparticles in ZnO/CuO composites leads to a decrease in their photocatalytic activity which appears to be due to dimming effect at UV exposition.

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References

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