Synthesis of $Zn_3(VO_4)_2$ – a Comparative Study

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Different synthesis methods were applied in order to prepare $Zn_3(VO_4)_2$ compound: melt quenching technique, conventional solid state synthesis and mechanochemically assisted solid synthesis. The phase and structural transformations were monitored by X-ray diffraction (XRD). The formation of $Zn_3(VO_4)_2$ was also confirmed by infrared spectroscopy (IR). Applying melt quenching method two different techniques were used: i) pouring the melt and press between two copper plates (cooling rate 10^2 K/s) and ii) roller technique (cooling rate 10^4–10^5 K/s). In both cases several phases ($Zn_4V_2O_9$, $Zn_2V_2O_7$, ZnO, V_2O_5, $Zn_3(VO_4)_2$) were detected on x-ray diffractograms. XRD patterns of mechanochemically activated precursors for different time (from 0,5 to 4 hours) shown presence of amorphous phase together with diffraction peaks of $Zn_4V_2O_9$ as dominated phase and Zn_2VO_4. Pure $Zn_3(VO_4)_2$ was prepared after heat treatment at 700 ^oC of mechanochemically activated sample. Using conventional solid state reaction $Zn_3(VO_4)_2$ was obtained as main crystalline phase. ZnO (3.5 wt.%) is also detected on diffractogram. It was established that mechanochemically assisted solid synthesis is more appropriated method for synthesis of $Zn_3(VO_4)_2$. The photocatalytic measurements were carried out on the $Zn_3(VO_4)_2$ powders obtained by both methods. Photocatalytic activity was evaluated by degradation of a model aqueous solution of Malachite Green (MG) upon UV-light irradiation.

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