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Mechanochemical synthesis and characterization of Ag-$BiVO_4$ nanocrystallites for photocatalysis applications

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Bismuth vanadate has become most promising material for photocatalytic applications from last decade due to its visible light driven reactions in the degradation of organic pollutants. However, it is well known that doping agents may enhance the catalytic activities. In this context, investigations on nano-sized $BiVO_4$ oxides doped by suitable metal ions are conducted in the aim to enhance the absorption in the visible spectral range and increase the efficiency of photocatalytic responses. Thus, highly crystalline silver loaded $BiVO_4$ are prepared by mechano-chemical reaction between bismuth oxide (Bi_2O_3) and vanadium oxide (V_2O_5) in a stoichiometric ratio of 1:1 and adding metallic silver particles (<10 mm) at different atomic percentages with respect to the host oxide material (2,4,6,8 and 10%). The suitable ball milling parameters are adjusted as well as the conditions of post-synthesis annealing in order to improve the crystalline features of the samples. Complementary characterization techniques were performed to analyze the main features of the samples. Thus, XRD analysis confirmed a major high crystalline monoclinic scheelite structure for all $BiVO_4$:Ag samples. High resolution TEM image reveals Ag presence in nano-particles along with BiVO4. The morphology of the samples investigated by FE-SEM shows particles with 50 nm sized and the effective doping by Ag ions was indeed demonstrated by (EDAX) technique. Optical absorption measurements reveal an evolution from 2.55 to 2.33 eV of $BiVO_4$ gap with Ag doping rates.

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