SYNTHESIS AND CHARACTERIZATION OF TITANIUM OXIDE – LEAD SULFIDE NANO HYBRID

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Sol-gel method has found increasing attention during recent years according to its high variety for the synthesis of materials. The nano materials synthesized via a sol-gel method exhibit high surface area and hence have an advantage over conventional materials for potential applications as catalyst or semiconductor [1-4]. In the other hand, semiconductor nanocrystals in transparent media have been the focus of attention due to their promising applications in non-linear optics and optical switches [5-6]. TiO_2 has been applied to a variety of environmental problems especially in water and air purification. It has antibacterial properties and is useful in the purification of water against different bacteria. One of the limiting factors, associated with the efficiency of photocatalysis is the fast recombination of charge carriers in the system. To challenge with this problem, it has been suggested that the coupling of semiconductors with appropriate energy levels can produce a more efficient photocatalyst via better charge separation. The SNCs like PbS or CdS have been introduced into TiO_2/SiO_2 matrix, although the content of NCs is lower (5–10 mol%). PbS is the most interesting for this aim. As the direct band gap energy of the bulk lead sulfide is 0.41 eV, this characteristic makes PbS clusters a good material for high-speed photonic switch applications. PbS NCs are suitable as saturable absorbers in Q-switched or mode-locked lasers. Composite SNCs in TiO_2 matrix are considerable because of their application in solar cells and optoelectronic devices In this research a binary phase material was prepared by sol-gel via: hydrolysis, sol formation, condensation to gel, un-reacted material removing and finally calcinations. Titanium oxide and lead sulfide were the ingredients of synthesized nano hybrid. TiO_2-PbS nanocomposite was prepared by tetraisopropyl orthotitanate (TIPT) and lead acetate precursors. Liquid state sol and chemical changes during the hydrolysis and polycondensation processes were also monitored. Mechanism of sol-gel formation has been also investigated by several spectroscopic techniques but FTIR spectroscopy seems to be of interest because of its sensitivity and selectivity, while no sample preparation step is required prior to analysis. Thus, the sol-gel synthesis of PbS–TiO_2 nanocomposite has been monitored by FTIR spectroscopy.

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