TiO_2 / ZnO Photocatalytic Activity for Hydrogen Production

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Abstract— The present work investigates Zn doped TiO_2 (1.0, 5.0, 8.0, 10.0, 12.0 and 30.0 wt.% Zn) photocatlaysts were prepared by low cost sol-gel auto-ignition method and systematically investigate their structural, optical and surface morphological properties with x-ray diffractometer, UV-Vis spectrophotometer, Fourier Transform Infrared spectrometer (FTIR) and scanning electron microscopy (SEM) with energy dispersive x-ray spectroscopy (EDX). The photocatalytic H_2 evolution of the TiO_2-ZnO suspensions was evaluated in an aqueous ethanol medium (50 vol. %) under UV illumination. The Zn^{+2} concentrations utilized to prepare TiO_2-ZnO nanocomposites were found to have significant effect on the specific surface area, pore volume, and photocatalytic activity. The H_2 evolution results obtained with TiO_2-ZnO nanocomposites were compared with H_2 generation using commercial TiO_2 P25 and individual TiO_2 nanoparticles. The photocatalytic activity of TiO_2-ZnO composite enhanced significantly as compared to bare TiO_2 nanoparticles and commercial TiO_2 P25. With respect to an increment in Zn^{+2} doped, the photocatalytic activity of the composite increased and reaching an optimal H_2 production of 1048 $\mu mol.h^{-1}$ of catalyst for the TiO_2-ZnO composite containing 10 wt.% Zn. These solids were proved in the photocatalytic water splitting and resulted seven times more active (1048 $\mu mol.h^{-1}$) than the reference TiO_2 (150 μmol.h-1) and two times more active than TiO_2 P25 (595 μmol.h-1) semiconductors.

Keywords— Hydrogen production, Photocatalysts TiO2–ZnO, Photoconductors TiO2–ZnO, Water splitting.