

(Research Article 5)

“Preparation of polyaniline/PbS core-shell nano/microcomposite and its application for photocatalytic H₂ electrogeneration from H₂O”

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Abstract:

Lead sulfide (PbS) and polyaniline (PANI) nano/microparticles were prepared. Then, PANI/PbS core-shell nano/microcomposites (I, II, and III) were prepared by oxidative polymerization of different aniline concentrations (0.01, 0.03, and 0.05 M), respectively, in the presence of 0.05 M PbS. FT-IR, XRD, SEM, HR-TEM, and UV-Vis analyses were carried out to characterize the samples. From the FT-IR data, there are redshifts in PbS and PANI nano/microparticles bands in comparison with PANI/PbS nano/microcomposites. The average crystallite sizes of PANI/PbS core-shell nano/microcomposites (I, II, and III) from XRD analyses were 46.5, 55, and 42.16 nm, respectively. From the optical analyses, nano/microcomposite (II) has the optimum optical properties with two band gaps values of 1.41 and 2.79 eV. Then, the nano/microcomposite (II) membrane electrode supported on ITO glass was prepared and applied on the photoelectrochemical (PEC) H₂ generation from H₂O. The characteristics current-voltage and current-time behaviors were measured at different wavelengths from 390 to 636 nm. Also, the incident photon-to-current conversion efficiency (IPCE) under monochromatic illumination condition was calculated. The optimum values for IPCE were 36.5 and 35.2% at 390 and 405 nm, respectively. Finally, a simple mechanism for PEC H₂ generation from H₂O using the nano/microcomposite membrane electrode was mentioned.