Introducing the novel composite photocatalysts to boost the performance of hydrogen (H2) production

ABSTRACT

Endeavor has been made in this work to develop a supported Si photocatalyst to efficiently split water into hydrogen under irradiation with visible light. Hydrothermal and solid phase reaction method were used to synthesize of Si/CNTs photocatalysts and characterized by using UV–visible optical absorption spectra (UV–Vis), Transmission electron microscopy (TEM), X-ray photoelectron spectroscopy (XPS), X-ray diffraction (XRD), and Scanning electron microscope (SEM) and etc. By examining their properties, it was found that the two types of surface dangling bonds existed on the surface of CNTs which greatly impacts on reaction efficiency. The generation of hydrogen (H2) onto supported Si catalyst may take place on hydroxyl and hydrogen bond with Si. The bandgap estimated from the reflection spectra was 2.2 eV for Si/CNTs photocatalyst. The highest generation of H2 of Si/CNTs was observed as 648 μmol h−1 which is greater than pristine Si without adding any hole-scavengers. The outcomes demonstrated that CNTs had a significant impact on photocatalytic water splitting activity because of high conductivity on remarkable net-like 2D structure. No apparent decrease in H2 production was detected after three successive runs representing the stability of the catalyst. Surface functions hold to achieve high efficiency in such a photocatalytic framework.