Semiconductors Heterojunctions for Enhanced Photocatalytic Hydrogen Production

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Semiconductor-based photocatalysis has received tremendous attention in the last few decades because of its potential for solving current energy and environmental problems. In a semiconductor photocatalytic system, photo–induced electron-hole pairs are produced when a photocatalyst is irradiated by light with frequencies larger than that of its band gap ($h\nu \geq Eg$). The photo-generated charge carriers can either recombine, or migrate to the surface of the semiconductor, where they can be involved in electrochemical processes. High recombination rate of charge carriers and limited efficiency under visible light irradiation are two limiting factors in the development of efficient semiconductor-based photocatalysts. To overcome these drawbacks, a number of strategies have been proposed and developed. Among these strategies, the design and preparation of semiconductor heterojunctions using two or more semiconductors is a promising approach. Recently studied examples of these semiconductor heterojunctions will be presented to demonstrate that well designed heterojunctions can extend light absorption range and enhance the lifetime of photogenerated charge-carriers resulting in enhanced photocatalytic activity compared to their individual components. Plausible mechanism (Figure 1) for the observed enhanced photocatalytic activity of the heterojunctions is proposed, and supported by photoluminescence and electrochemical impedance spectroscopy.

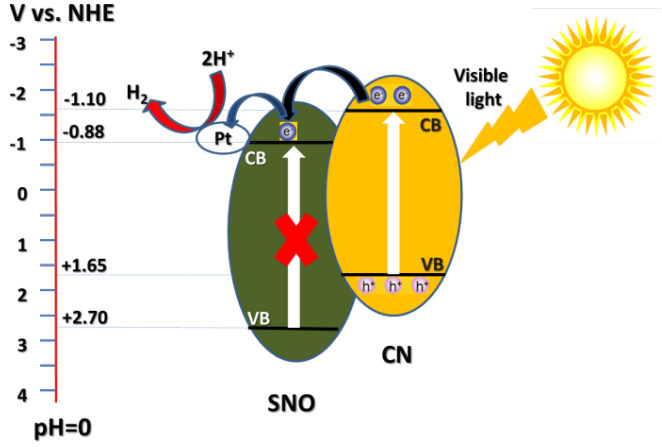

Figure 1. Schematic diagram of separation and transfer of photogenerated carriers in g-C_3N_4 /$Sr_2Nb_2O_7$ heterojunction under visible light irradiation.

Contribution: Invited