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Development of Composite Materials for CO2 Reduction and Organic Compound Decomposition

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Abstract : Visible-light-responsive g-C3N4/NaNbO3 nanowires photocatalysts were fabricated by introducing polymeric g-C3N4 on NaNbO3 nanowires. The microscopic mechanisms of interface interaction, charge transfer and separation, as well as the influence on the photocatalytic activity of g-C3N4/NaNbO3 composite were systematic investigated. The HR-TEM revealed that an intimate interface between C3N4 and NaNbO3 nanowires formed in the g-C3N4/NaNbO3 heterojunctions. The photocatalytic performance of photocatalysts was evaluated for CO2 reduction under visible-light illumination. Significantly, the activity of g-C3N4/NaNbO3 composite photocatalyst for photoreduction of CO2 was higher than that of either single-phase g-C3N4 or NaNbO3. Such a remarkable enhancement of photocatalytic activity was mainly ascribed to the improved separation and transfer of photogenerated electron-hole pairs at the intimate interface of g-C3N4/NaNbO3 heterojunctions, which originated from the well-aligned overlapping band structures of C3N4 and NaNbO3. Pt loaded NaNbO3-xNx (Pt-NNON), a visible-light-sensitive photocatalyst, was synthesized by an in situ photodeposition method from H2PtCl6•6H2O onto NaNbO3-xNx (NNON) sample. Pt-NNON exhibited a much higher photocatalytic activity for gaseous 2-propanol (IPA) degradation under visible-light irradiation in contrast to NNON. The apparent quantum efficiency (AQE) of Pt-NNON sample for IPA photodegradation achieved up to 8.6% at the wavelength of 419 nm. The notably enhanced photocatalytic performance was attributed to the promoted charge separation and transfer capability in the Pt-NNON system. This work suggests that surface nanosteps possibly play an important role as an electron transfer at high way, which facilitates to the charge carrier collection onto Pt rich zones and thus suppresses recombination between photogenerated electrons and holes. This method can thus be considered as an excellent strategy to enhance photocatalytic activity of organic decomposition in addition to the commonly applied noble metal doping method.

Keywords : CO2 reduction, NaNbO3, nanowires, g-C3N4
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