Supporting Information

Fabrication of CdS/BNNSs nanocomposites with broadband solar absorption for efficient photocatalytic hydrogen

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S1 FTIR spectra of the as-obtained CdS/BNNSs nanocomposites

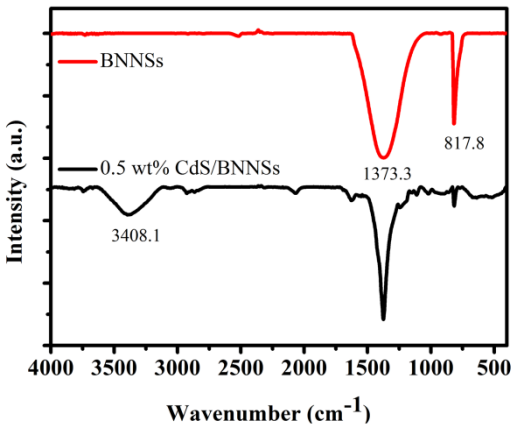

Fig. S1 FTIR spectra of BNNSs and CdS/BNNSs nanocomposites.

FTIR spectra of the pure BNNSs and CdS/BNNSs nanocomposites were measured. As shown in Fig. S1, the FTIR spectrum of BNNSs shows the structure nature of h-BN. Two strong absorption peaks of BNNSs are observed at 1373.3 and 817.8 cm^{-1}. The peak around 1373.3 cm^{-1} results from the in-plane B-N transverse optical modes of the sp^2-bonded h-BN, while the peak centered at 817.8 cm^{-1} could be attributed to the B-N-B out-of-plane bending vibration.[1] After the composite reaction, the B-N peak shifts slightly which is attributed to slight change of π electrons interactions resulting from the interactions between BNNSs and CdS nanoparticles. Meanwhile, the B-N peak is still obvious even at a very low BNNSs content which shows BNNSs has a high intensity of absorption. Furthermore, new peaks appeared and all these new peaks show the functional group on the surface of CdS nanoparticles. For example, the peak around 3408.1 cm^{-1} can be attributed to the -OH group on the surface of CdS, and the peaks from 1000-1200 cm^{-1} are caused by the asymmetric stretching vibration of S-O group.

S2 Raman spectra of the as-obtained CdS/BNNSs nanocomposites

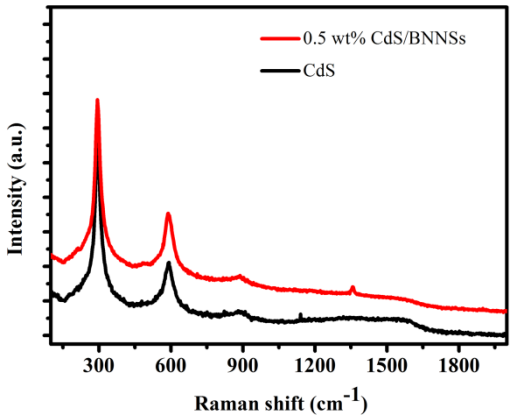

Fig. S2 Raman spectra of CdS and CdS/BNNSs nanocomposites.

Raman characterization for the as-obtained products was performed on the Si/ SiO_2 substrate. Typical Raman spectrum of CdS nanoparticles show two dominant peaks at 293.7 and 589.1 cm^{-1} which are correspond to the longitudinal optical phonons of CdS.[2] Meanwhile, the characteristic absorption peak of BNNSs at 1366.4 cm^{-1} is observed on the spectra. The as-prepared CdS/BNNSs nanocomposites have no new peaks compared with pure CdS which suggests that there is no new phase was produced.

S3 Photocatalytic quantum efficiency (QE) of the as-obtained CdS/BNNSs nanocomposites

Samples	1	2	3	4	5	6	7	8
BNNSs content (wt%)	0	0.1	0.5	1.0	1.5	100	0	0.5
Pt (wt %)	0	0	0	0	0	0	0.5	0.5
QE (%)	0.296	0.467	0.734	0.346	0.245	0	4.079	9.301

S4 Selected area electron diffraction (SAED) patterns of CdS nanoparticles and BNNSs

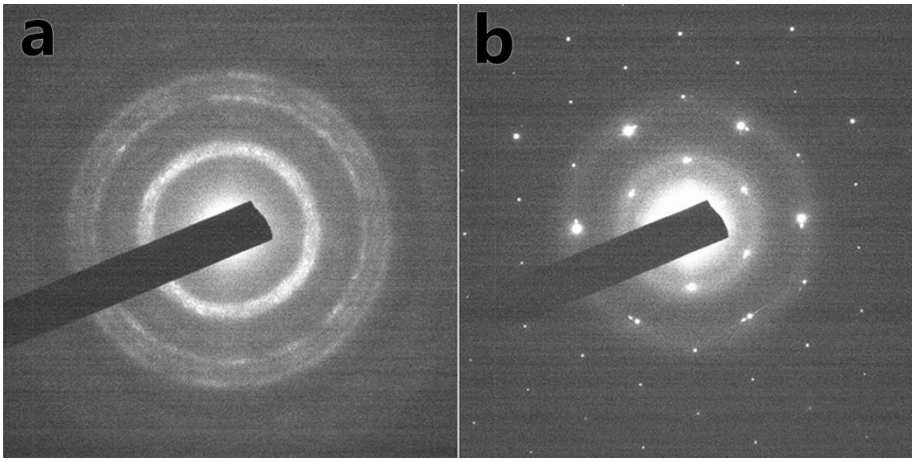

Fig. S4 The SAED patterns of CdS nanoparticles (a) and BNNSs (b).

The SAED pattern of CdS nanoparticles in Fig. S4a showed the characteristics of polycrystalline, which meant the as-obtained CdS nanoparticles was polycrystalline.[3] The SAED pattern of BNNSs was shown in Fig. S4b. Since h-BN belongs to hexagonal layered structure and BNNSs keep well-crystallized after the exfoliation process, the SAED pattern was monocrystalline.[4]

S5 UV−vis diffuse reflectance spectra (DRS) of BNNSs, CdS nanoparticles and CdS/BNNSs nanocomposites.

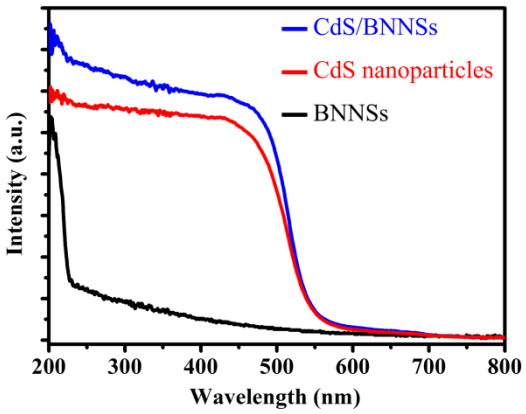

Fig. S5 The UV−vis DRS results of BNNSs, CdS nanoparticles and CdS/BNNSs nanocomposites.

The UV−vis diffuse reflectance spectra (DRS) were employed to investigate the optical properties of the as-obtained CdS/BNNSs nanocomposites. As a well-known visible-light-induced photocatalyst, pure CdS nanoparticles, with a bandgap of 2.4 eV, absorb visible light with wavelengths shorter than 510 nm. The as-obtained 0.5 wt% CdS/BNNSs nanocomposites enhanced absorption intensity, particularly in the ultraviolet region. It was speculated that there were more photo electrons generated under photoexcitation, and these photo electrons can transmit through the chemical connection between BNNSs and CdS nanoparticles. So, all these phenomena suggest the rate of photocatalytic H_2 evolution can be enhanced.

References

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