

Electronic Supporting Information

Hierarchical 3D NiO/CdS Heteroarchitecture for Efficient Visible Light Photocatalytic Hydrogen Generation

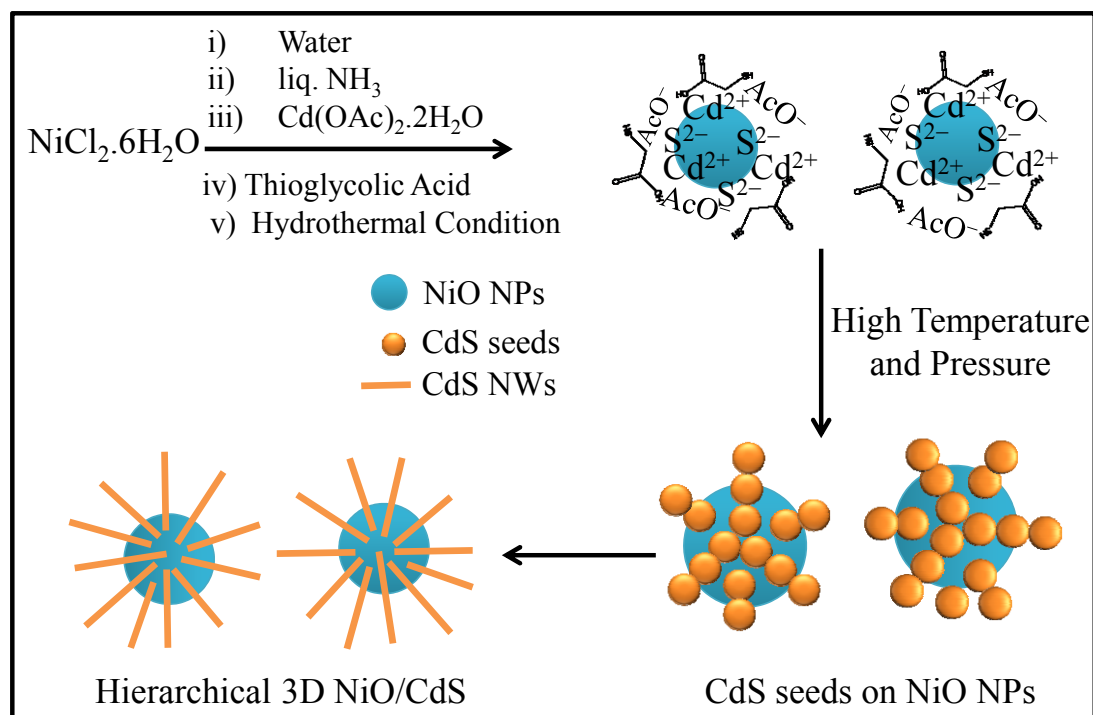
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Mechanism for the formation of hierarchical 3D NiO/CdS binary heteroarchitecture

Previously our group has demonstrated the directed growth of 1D CdS NWs on Al₂O₃ and ZnO nanoparticles [1]. Based on the above discussion we proposed a mechanism for the formation of hierarchical 3D NiO/CdS heteroarchitecture. The graphic presentation for the formation of 3D NiO/CdS is shown in scheme 1.



Scheme 1: Schematic presentation for the formation of hierarchical 3D NiO/CdS heteroarchitecture.

The growth mechanism of CdS on NiO can be explained on the basis of Lewis acidic character of Ni^{2+} . The growth mechanism may follow these steps

- Formation of NiO NPs in hydrothermal condition.
- Attachment of S^{2-} to NiO nanoparticles because of the Lewis acidic nature of Ni^{2+} in the solution.
- Cd^{2+} ion is also present in the solution which encourages the formation of CdS nanoparticles at high temperature and pressure.
- Saturated CdS may act as seed for the formation and growth of CdS NWs onto NiO NPs in hydrothermal condition, thereby leading the formation of hierarchical 3D NiO/CdS heteroarchitecture.

Experimental setup for photocatalytic hydrogen generation

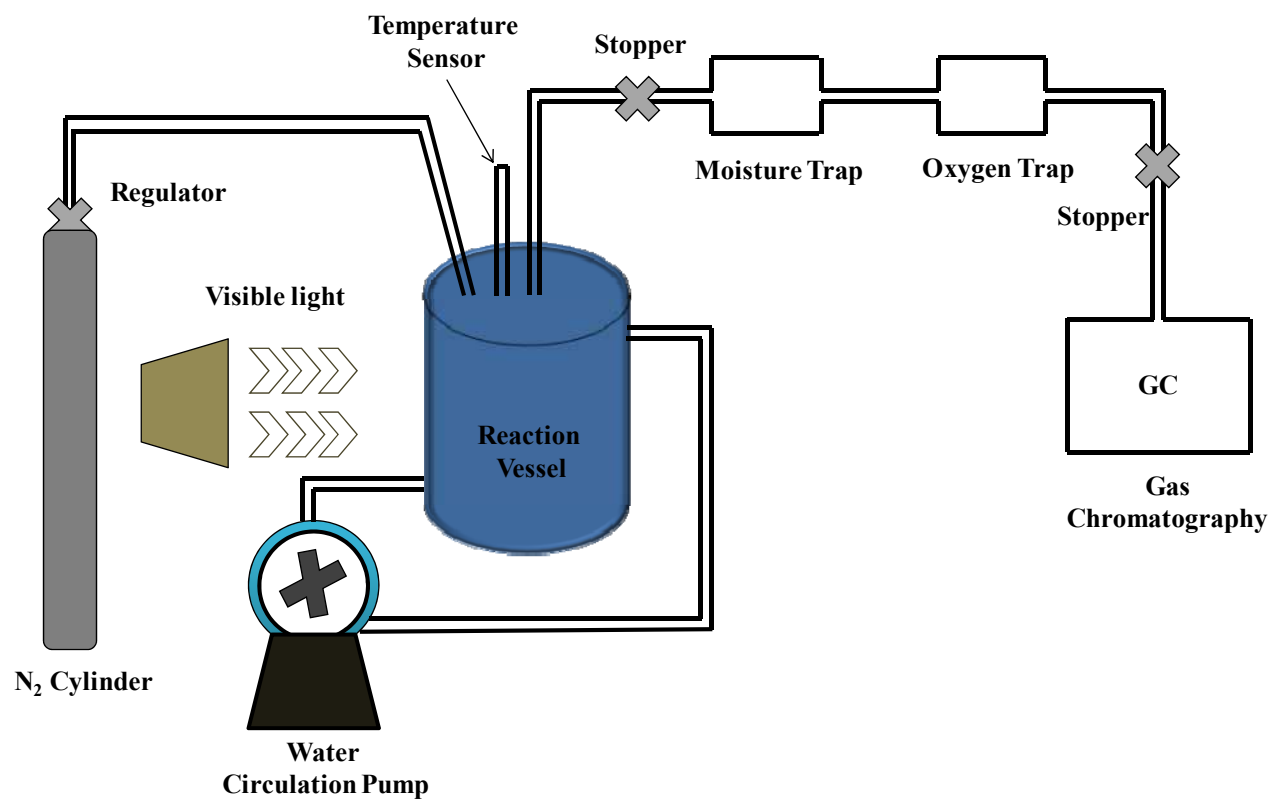


Figure S1 Schematic demonstration of photocatalytic hydrogen generation by water splitting.

Lamp Emission Profile

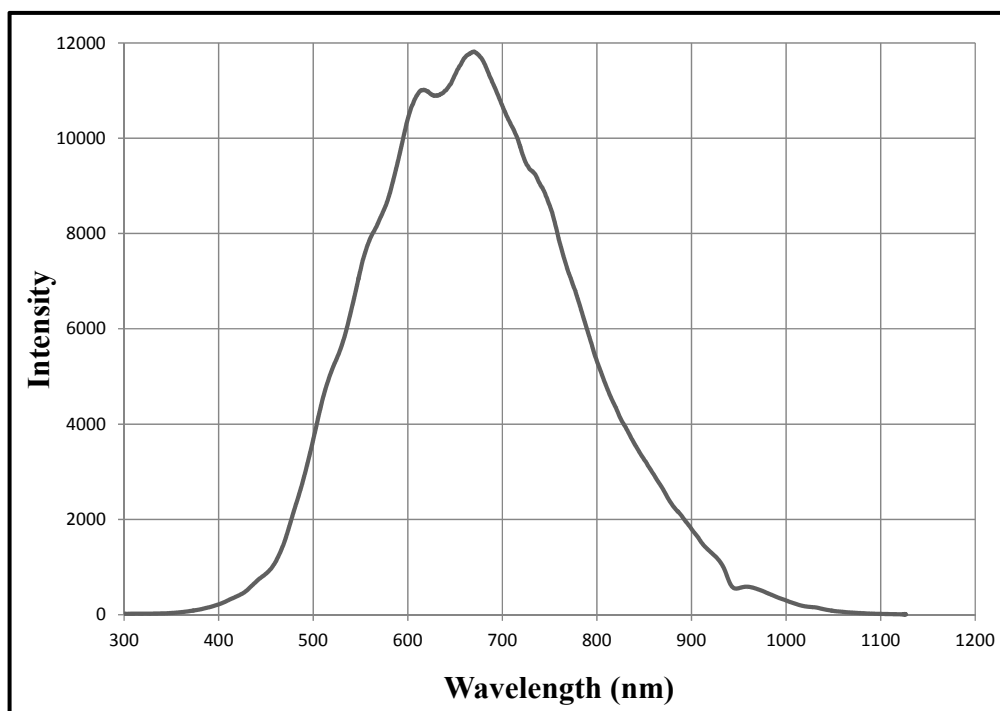


Figure S2 Emission spectrum of the 500 W tungsten halogen lamp.

Scanning Electron Microscope (SEM) images of hierarchical 3D NiO/CdS

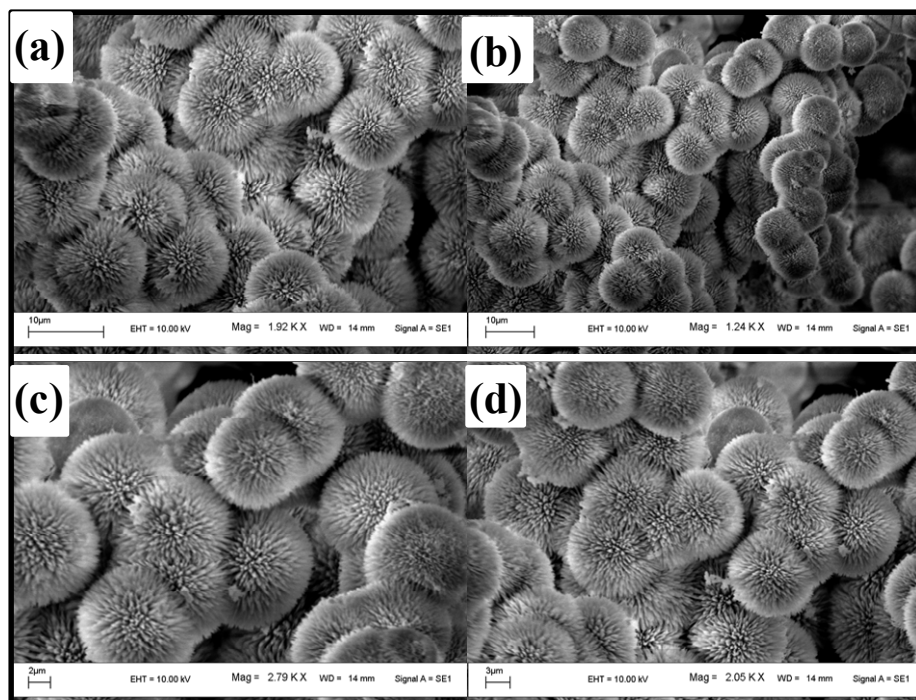


Figure S3 SEM images of hierarchical 3D NiO/CdS at different magnifications.

Tauc Plot for band gap calculation for CdS NWs, NiO NPs and hierarchical 3D NiO/CdS heteroarchitecture

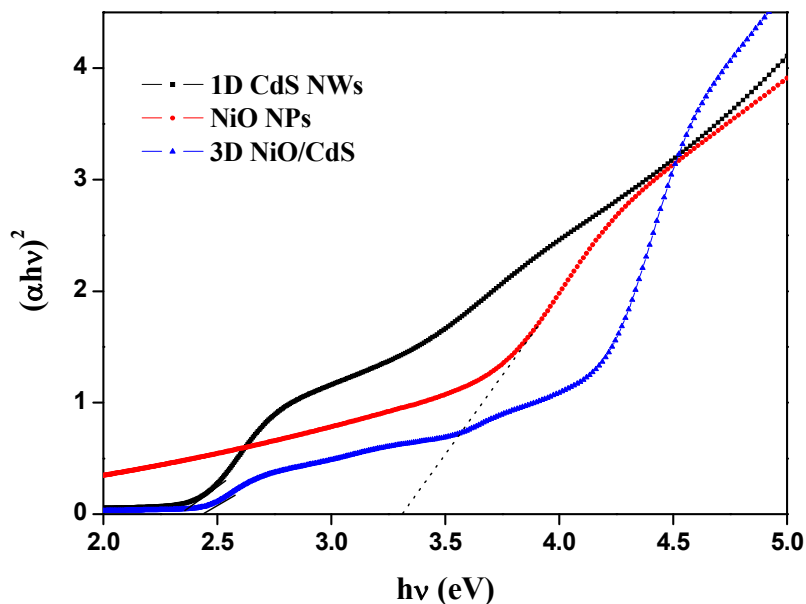


Figure S4 Tauc's plot of $(\alpha h\nu)^2$ versus photon energy for the optical band gap calculation for 1D CdS NWs, NiO NPs, and 3D NiO/CdS heteroarchitecture.

Nitrogen adsorption-desorption isotherms plot for CdS NWs and hierarchical 3D NiO/CdS heteroarchitecture

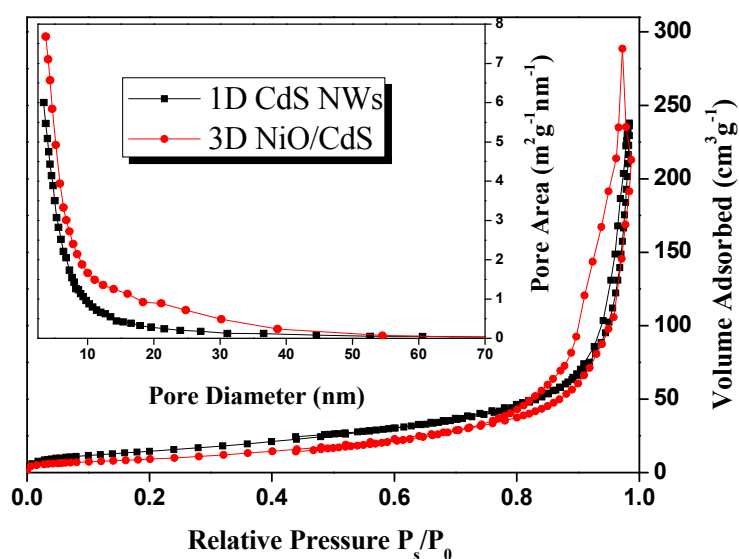


Figure S5 Nitrogen adsorption-desorption isotherms and the pore size distribution plots for 1D CdS NWs and hierarchical 3D NiO/CdS heteroarchitecture. Inset shows the plot of pore area versus pore diameter (BJH plot for pore size distribution).

Reference

- 1- Khan, Z.; Barpuzary, D.; Baswant, O.; Sutradhar, S.; Qureshi, M. *Mater. Lett.* **2011**, 65, 1168.