

Electronic Supplementary Information

Experimental section

Synthesis of Cu₂O nanocube precursor

In a typical synthesis process, 100 mL distilled water homogeneous solution was formed with the addition of 0.17 g CuCl₂·2H₂O and 0.11 g PVP (*M_w*30000) under the conditions of a constant stirring and a water bath of 55 °C. Then, into the above transparent light green solution NaOH (10.0 mL, 2.0 M) aqueous solution was added dropwise, and a turbid blue-green and then dark brown solution was observed after a string of 0.5 h. Consequently, after the addition of an ascorbic acid solution (10.0 mL, 0.6 M), a turbid red liquid was gradually formed. With an aging process of 3 h, the resulting precipitate was harvested by several rinse-centrifugation cycles with deionized water and absolute ethanol, then dried under vacuum condition at 70 °C for 10 h and stored for further use.

Preparation of hollow CeO₂@TiO₂ nanocube Heterostructures

To synthesize the hollow CeO₂@TiO₂ nanocube sample, into a mixture solution of 25 mL deionized water and 25 mL absolute ethanol, 50 mg Cu₂O nanocube precursor and 0.725 g PVP (*M_w* 30000) were dispersed under a constant stirring at room temperature. Afterward, 40 mg Ce(NO₃)₃·6H₂O was added to the above solution and stirred for 10 min, after which 40.0 mL Na₂S₂O₃·6H₂O solution (1.0 M) was added into the mixture solution dropwise with a continual stirring for 20 min. Then into the above mixture liquid a titanyl sulphate solution (25.0 mL, 0.1 M) was added dropwise. The mixture was stirred for 3 h. Finally, the resulting precipitate was obtained by centrifugation and washed with deionized water and absolute ethanol several times. After a treatment under vacuum at 70 °C overnight, the product was calcined in an electrical furnace under air atmosphere at 450 °C for 4 h. Then the hollow CeO₂@TiO₂ nanocubes were obtained.

Characterization

X-ray diffraction (XRD) was carried out to identity the phase composition of synthesized samples over the 2θ range from 20° to 90° using a Rigaku D/max-A diffractometer with Co Kα radiation. A Fourier transform infrared spectroscope (FTIR, Themo Nicolet 670FT-IR) was used for recording the FTIR spectra of the sample ranged from 450 to 4500 cm⁻¹. Morphologies of the synthesized samples were observed with a AMRAY 1000B scanning electron microscope (SEM), and the microstructural characteristics of samples were observed by high-resolution transmission electron microscope (HR-TEM,

JEOL JEM-2100) working at 200 kV accelerating voltage and the lattice structure was identified by selected area electron diffraction (SAED) technique. Nitrogen adsorption-desorption measurements were conducted at 77 K on a Micromeritics Tristar apparatus. Specific surface areas were determined following the Brunauer-Emmet-Teller analysis.

photocatalytic detoxification of cyanide

photocatalytic detoxification of cyanide was investigated using 300W Xe lamp with a 420 nm cutoff filter as the visible light sources. The photodegradation experiments were conducted by using a cylindrical quartz reactor with water circulation facility. For detoxification of cyanide, solutions of cyanide of the needed concentration at pH 12.5 were prepared fresh. The volume of the reaction solution was kept as 50 mL for visible light photocatalysis. Air was bubbled through the reaction solution to keep the suspended particles under continuous motion. The dissolved oxygen was determined using a luminescent optical dissolved oxygen analyzer GE-135. The cyanide ion was estimated argentometrically using p-dimethylaminobenzylidene rhodamine as the indicator.

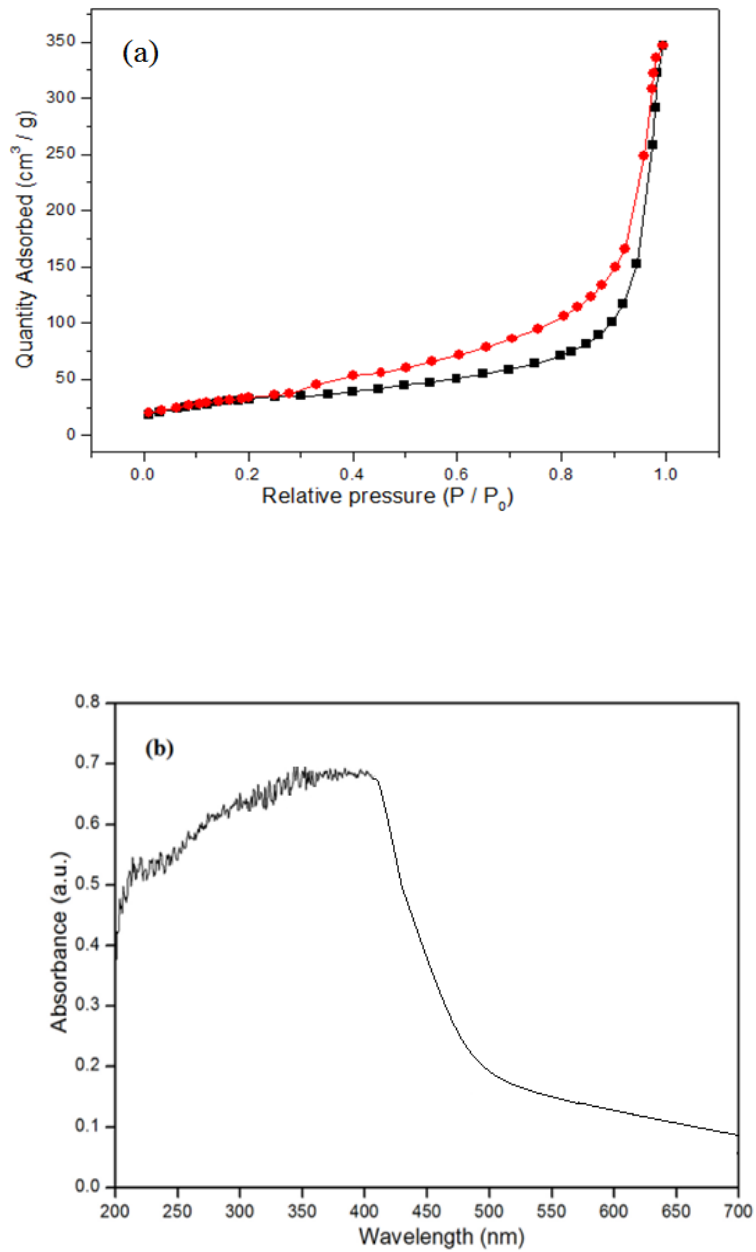


Fig. S1 Nitrogen adsorption/desorption isotherm (a) and UV-Vis diffuse reflectance spectrum (b) of TiO₂@CeO₂ hybrid nanocubes.

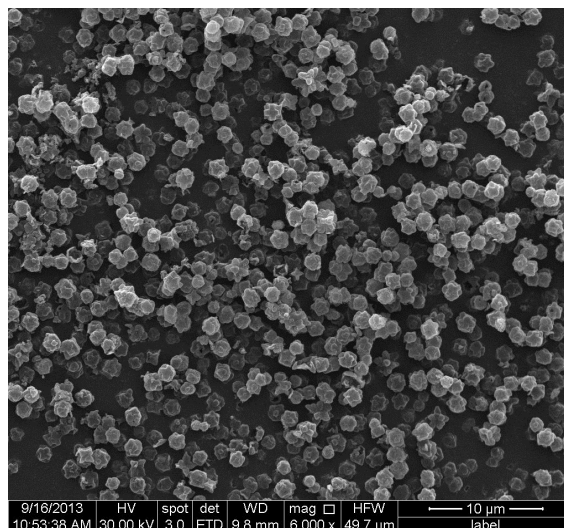


Fig. S2 SEM image of the obtained hollow TiO₂ nanocubes.

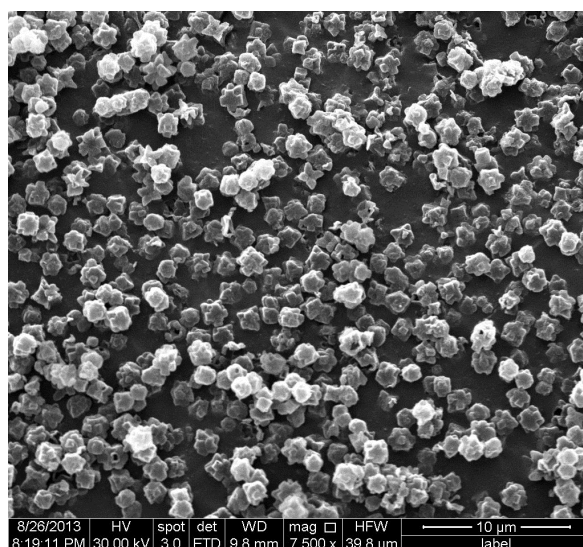


Fig. S3 SEM image of the obtained hollow NiO nanocubes.