

Heterojunctions photocatalyst constructed by modification of 2D-CeO₂ on 2D-MoS₂ nanosheets with enhanced degrading activity

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Experimental

2.3. Characterization, detailed experimental process

In order to analyze the crystal structure and phase purity, the prepared samples are characterized by a D8ADVANCE X-ray diffractometer (Bruker AXS Co., Germany) at room temperature, and record the X-ray diffraction (XRD) patterns at 10-80° with a scanning step of 7°/min. For getting the energy dispersive x-ray spectra (EDX), an EDS Inca X-Max (Oxford, UK) is used. An EDS Inca X-Max (Oxford, UK) is used to obtain the energy dispersive x-ray spectra (EDX). In order to acquire transmission electron microscope (TEM) and the high-resolution transmission electron microscopy (HRTEM), a sample is investigated with JEM-2100F transmission electron microscopy (JEOL, Japan). Using Thermo ESCALAB 250X (America) to describe the X-ray photoelectron spectroscopy (XPS). The diffuse reflectance spectra (DRS) (UV-2450; Shimadzu, Japan) is also performed to observe the light absorption and energy band features of photocatalysts. The surface area, pore volume and average pore size of these photocatalysts are examined by a NOVA 3020e analytical system (Quantachrome Co., U.S.A.), and it can attain the Brunauer-Emmett-Teller (BET) measure. A VersaSTAT 3 electrochemical station (Princeton Applied Research, American) is used in this part to research transient photocurrent and electrochemical impedance spectroscopy (EIS). For analyzing the intermediate degradation product, the mass spectrometry is carried out using a HPLC-MS instrument composed of Perkin-Elmer Norwalk, CT) Series 2000 HPLC with the Finnigan MAT900 mass. In the end, electron spin resonance (ESR) spectroscopy is gone on a Bruker A300 ESR spectrometer at room temperature.

To evaluate the photocatalytic activities of as-prepared various samples, the degradation experiments of CIP are carried out as bellow. A 250 W xenon lamp with a 420 nm cutoff filter is applied as a light source. The photocatalytic experiments are as following: 50 mg photocatalyst is added into 100 mL solution which contains 10 mg/mL CIP. Then the solution is stirred for 30 min to achieve the adsorption-desorption equilibrium. After that, the solution of 5 mL is sampled and centrifuged at 20 min intervals. Furthermore, the active species trapping experiments are as same as the above photocatalytic experiments, only add 1 mL triethanolamine (TEOA, a quencher of h^+), 1 mL isopropanol (IPA, a quencher of $\cdot OH$), and 0.176 g Vitamin c (Vc, a quencher of $\cdot O_2^-$) respectively to catch various radicals during the

photocatalytic reducing course. Then an UV-vis spectrophotometer is used to monitor the supernatant.

In order to detect the photoelectrochemical performance, the 2D/2D heterojunction of MoS₂/CeO₂ is tested by the photocurrent response and electrochemical impedance spectroscopy (EIS) in a 450FRA 2A electrochemical station. Shortly, 0.05 g photocatalyst and 0.01 g polyvinyl pyrrolidone (PVP) are dissolved in 3 mL ethanol and 30 μ L oleic acid. Then 0.05 ml of this mixture is dipped onto FTO substrates (1.0 cm²) and regarded as corresponding working electrodes. And a Pt plate and a saturated Ag/AgCl electrode are as the counter electrode and the reference electrode respectively. In addition, a 0.5 M Na₂SO₄ aqueous solution was used as the electrolyte.

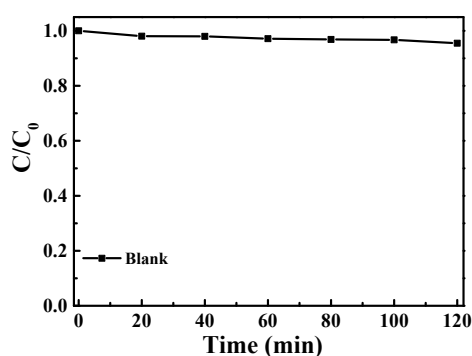


Fig.S1. The photodegradation experiment without photocatalyst.

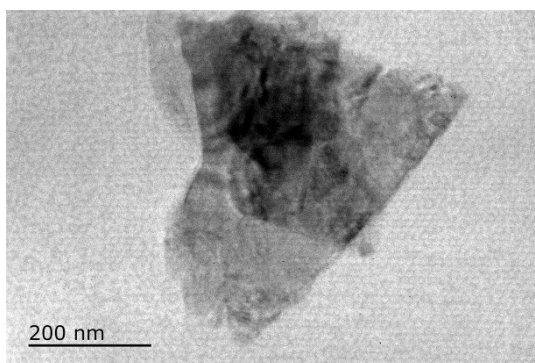


Fig. S2. TEM images of pure MoS₂.

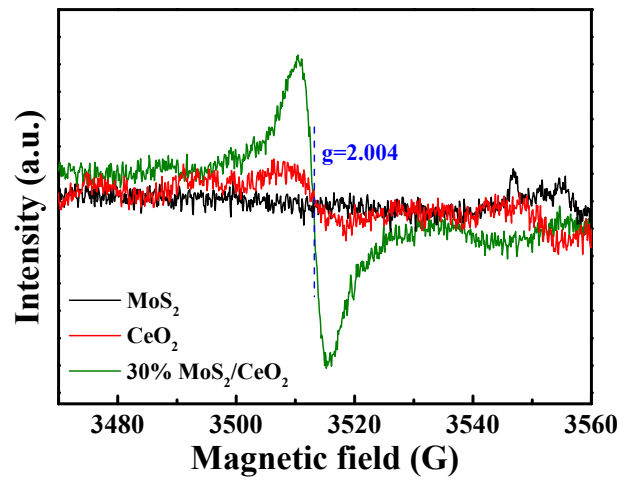


Fig. S3. EPR spectra of pure MoS₂, CeO₂ and 30% MoS₂/CeO₂.