Supplementary Information

A novel type-II NiCo-LDH/CeO_2 heterojunction for highly efficient photocatalytic H_2 production

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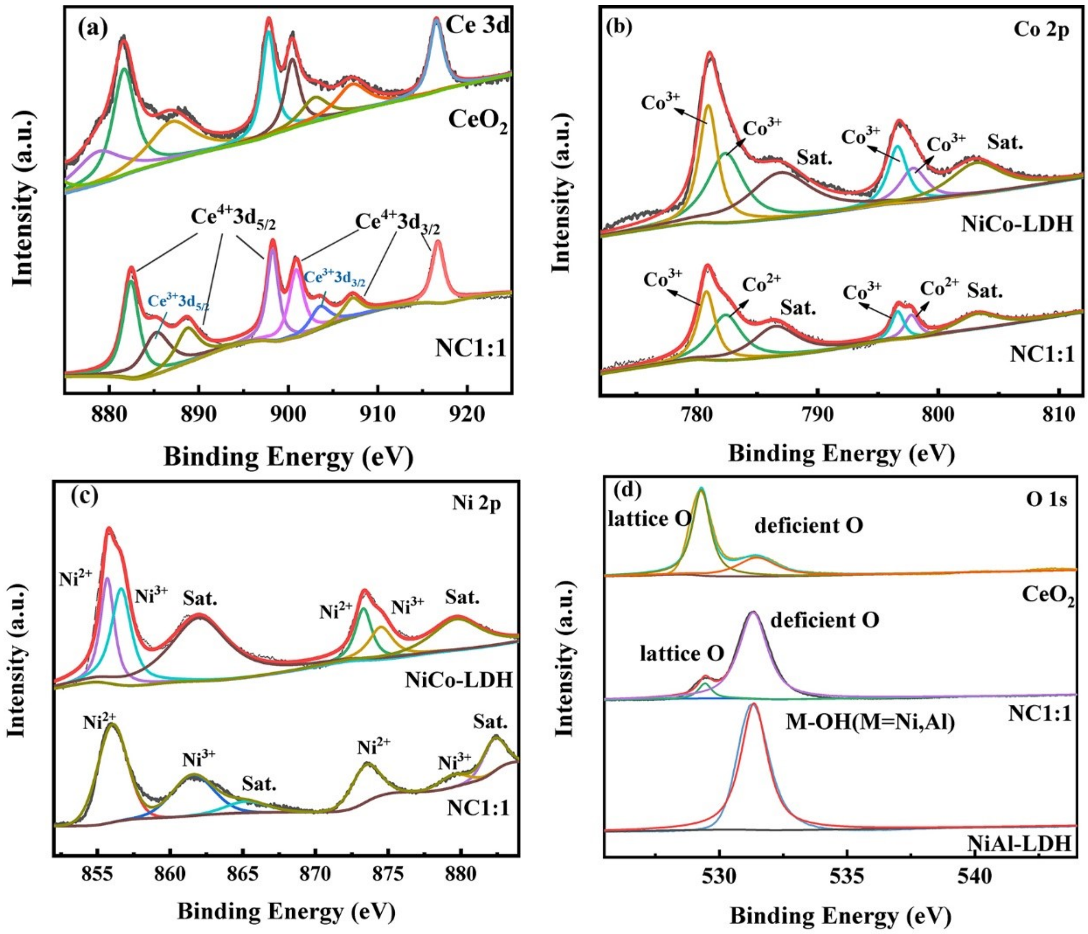
1. Detail of material characterization and performance measurements

1.1 Material characterization

The crystal structure of photocatalyst was recorded by X-ray diffractometer. The structure and morphology of the photocatalyst were observed by scanning electron microscope (SEM) and transmission electron microscope (TEM). The chemical elements and valence states of the samples were studied by X-ray photoelectron spectroscopy (XPS). The UV-Vis diffuse reflectivity spectra (UV-vis DRS) of the photocatalyst were recorded using $BaSO_4$ as the back and back of the UV visible spectrometer. At 77 K, the BET specific surface area of the samples was determined by nitrogen adsorption desorption method. The photoluminescence (PL) and time-resolved photoluminescence spectra (TRPL) of the samples were studied by fluorescence spectrophotometry. The electrochemical activity of the samples was determined by electrochemical workstation CHI660E. In 0.2 mol·L Na_2SO_4 saturated aqueous solution, Ag/AgCl electrode and Pt electrode were used as reference electrode and counter electrode respectively. The working electrode was ITO glass coated with different sample powders with an effective area of 1 cm^2 (1cm×2cm). The photocurrent response curves (I-T) of different samples were measured by intermittent switching on and off xenon lamp with 300 W light source. Electrochemical impedance spectroscopy (EIS) of different samples was measured at a bias of -0.2 V.

1.2 Hydrogen production condition

The photocatalytic production hydrogen was carried out in an airtight quartz bottle, which could be degassed and sampled. Usually, 10mg of catalytic material, 20mg of Eosin Y (EY), and 30 mL of TEOA solution containing 10%were weighed and added into a quartz flask. Before the solution was illuminated by visible light, the reactant system was degassed by vacuuming to remove excess gas from the solution. The amount of hydrogen evolution was analyzed by online gas chromatograph (SP 2100, N_2 as carrier).



S1. electron transfer contrast

Table 1. Comparison of the H_2 production activity of NiCo-LDH/CeO_2 photocatalyst and the recently reported photocatalyst.

Photocatalyst	Scavenger	Light source	H_2 evolution rate (μmol g^{-1} h^{-1})	Ref
NiCo-LDH/CeO_2	TEOA	5 W LED lights	2700	本文
NiAl-LDH/MoS_2	TEOA	5 W LED lights	4590	[1]
CoO/NiCo-LDH	0.2 M Na_2SO_3 and 0.2 M Na_2S	100 mW cm^{-2}Xe lamp	1500	[2]
NiAl-LDH/Ti_3C_2/g-C_3N_4	TEOA	35 W Ballast CAR HID Lamp	180	[3]
Ag-pCN/TiO_2	glycerol-water mixture.	35 W HID Xe lamp	3160	[4]

g-C_3N_4/ CoAl-LDH/	TEOA	300 W Xe lamp	680.13	[5]
CeO_2/WO_3	10 vol% ethanol	300 W lamp	410	[6]
Pt-CeO_2/g-C_3N_4	TEOA	300 W Xe-lamp	860	[7]
CeO_2/CoS_2	TEOA	5 W LED	5172	[8]

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