

Supporting Information

**Facile Fabrication of Ternary NiTiFe-LDH Ultrathin Nanosheets for  
Efficient Conversion of Amines to Imines under Visible Light**

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## Characterizations

X-ray diffraction (XRD) patterns were collected on a Miniflex 600 X-ray diffractometer (Rigaku, Japan) with Cu K $\alpha$  radiation ( $\lambda=0.15406$  nm). The accelerating voltage and the applied current were 40 kV and 20 mA, respectively. Data were recorded at a scanning rate of 0.02, 2 $^\circ$ /min in the range of 3 $^\circ$  to 70 $^\circ$ . X-ray photoelectron spectra (XPS) were measured with a PHI Quantum 2000 Spectrometer (PHI, USA) with a monochromatic Al-K $\alpha$  source (1486.6 eV). All the binding energies were referenced to the C1s at 284.6 eV of the surface adventitious carbon. The base pressure inside the analysis chamber was maintained at  $<10^{-10}$  mbar. The XPS spectra were analyzed using Avantage software. Sherry function is used to deduct the background and Near-Gaussian Gaussian-Lorentzian function is used to fit the curve. The morphology of the samples was obtained by a field emission scanning electron microscopy (SEM, JSM-6700F) with an accelerating voltage of 15 KV. Transmission electron microscopy (TEM) and high-resolution TEM (HRTEM) images were measured by JEOL model JEM 2010 EX instrument at an accelerating voltage of 200 kV. A tapping-mode atomic force microscope (AFM, Bruker Dimension Icon) was used to determine the thickness of the samples. The ultraviolet-visible diffuse reflectance spectra (UV-Vis DRS) were measured using a UV-vis spectrophotometer (Varian Cary 500). Barium sulfate (BaSO $_4$ ) was used as a reference. Electron spin resonance (ESR) spectra were obtained with a Bruker ESP 300E electron paramagnetic resonance spectrometer at room temperature. The photoelectrochemical analysis was measured on an electrochemical analyzer (Zahner, Germany) in a standard three electrode system using the as-obtained sample-coated ITO as the working electrode, a Pt wire as the counter electrode, and Ag/AgCl (in saturated KCl) as a reference electrode. The transient photocurrent responses were measured in 0.2 M Na $_2$ SO $_4$  aqueous solution. Electrochemical impedance spectroscopy (EIS) were measured in a mixture of KCl (0.5 M), K $_3$ [Fe(CN) $_6$ ] (0.01 M) and K $_4$ [Fe(CN) $_6$ ] (0.01 M) aqueous solution. The photoluminescence (PL) spectroscopy was measured on an Edinburgh FLS 980 spectrophotometer under the excitation of 325 nm, and fluorescent lifetimes spectroscopy was obtained using a microsecond pulse lamp as the exciting source (325 nm).

## Photocatalytic reaction

The photocatalytic reaction was carried out in a sealed Schlenk tube irradiated with

a Blue LED lamp. Typically, amine (0.1 mmol) in solvent (2 mL) was transferred to a Schlenk tube containing 15 mg of photocatalyst, with the reaction connected to an oxygen-filled balloon. The reaction tube was irradiated with a blue LED lamp for 26 h. After the reaction, the product was isolated by a porous membrane and the filtrate was analyzed using a GC-FID (Shimadzu GC-2014) with a RTX-5 capillary column.

## Supporting Figures

Fig. S1 ESR spectra for NiTiFe-LDH NSs.

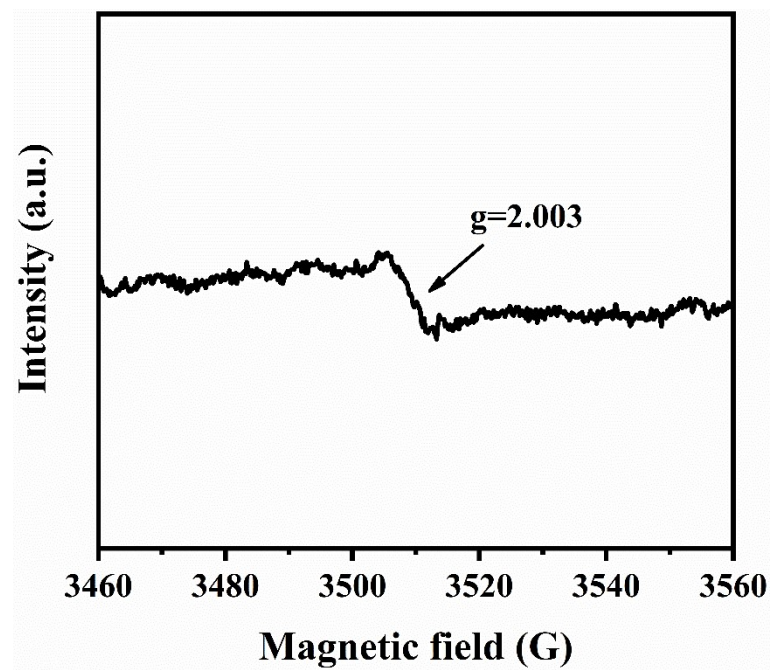


Fig. S2 SEM image of bulk NiTiFe-LDH

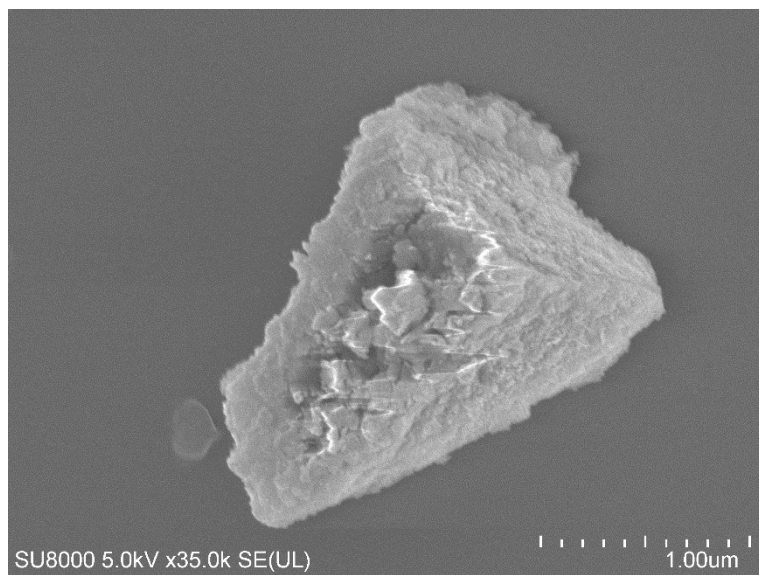


Fig. S3 Tauk plot for (a) NiTiFe-LDH NSs and (b) bulk NiTiFe-LDH

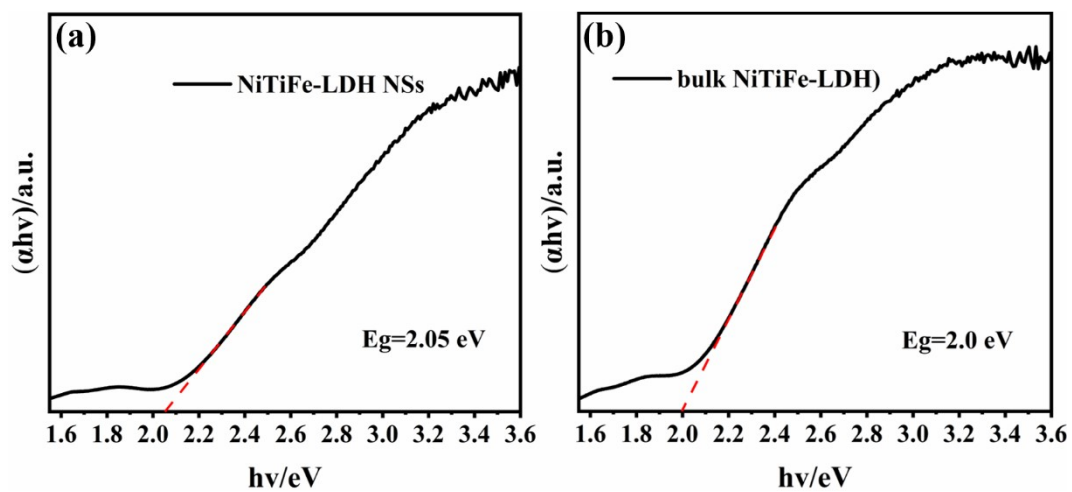


Fig. S4 DMPO spin-trapping ESR spectra of a reaction system containing benzylamine, H<sub>2</sub>O, DMPO and the photocatalyst.

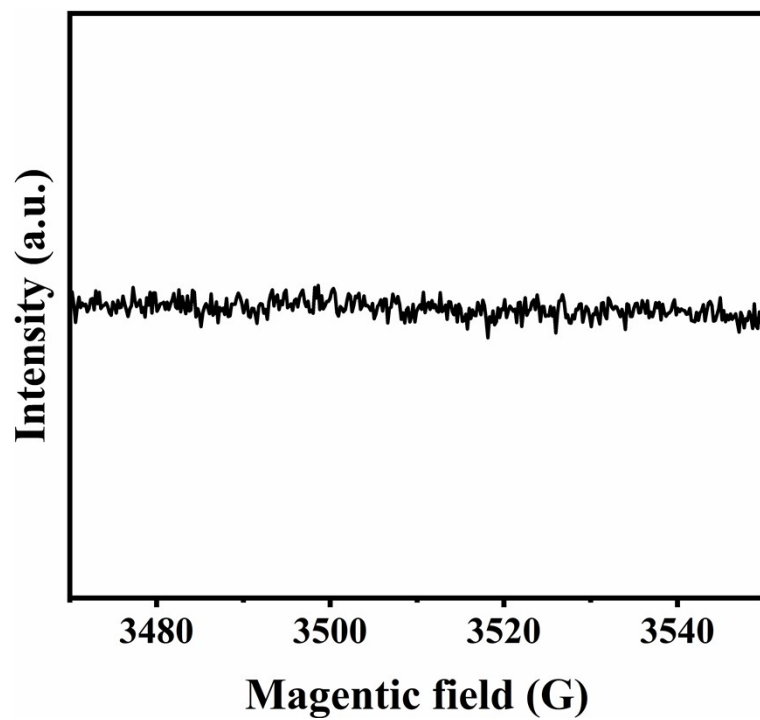


Fig. S5 XRD patterns of NiTi-LDH

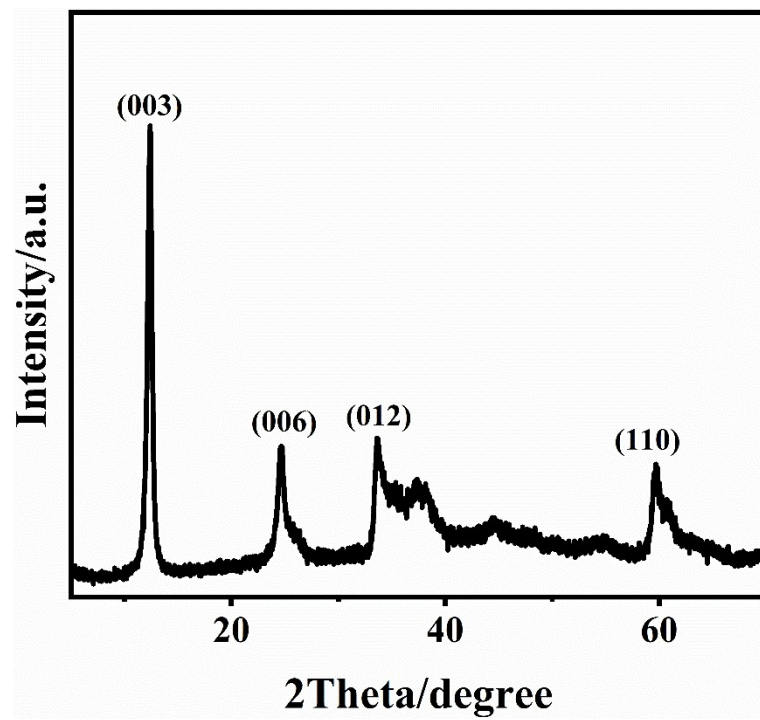




Fig. S6 SEM image of NiTi-LDH

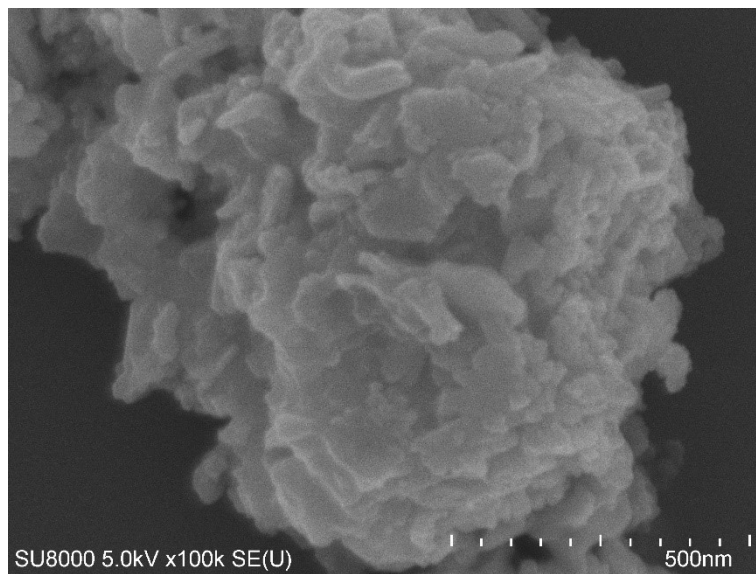


Fig. S7 (a) Photoluminescence (PL) spectroscopy NiTiFe-LDH NSs, bulk NiTiFe-LDH and NiTi-LDH, (b) Fluorescent lifetimes spectroscopy NiTiFe-LDH NSs, bulk NiTiFe-LDH and NiTi-LDH.

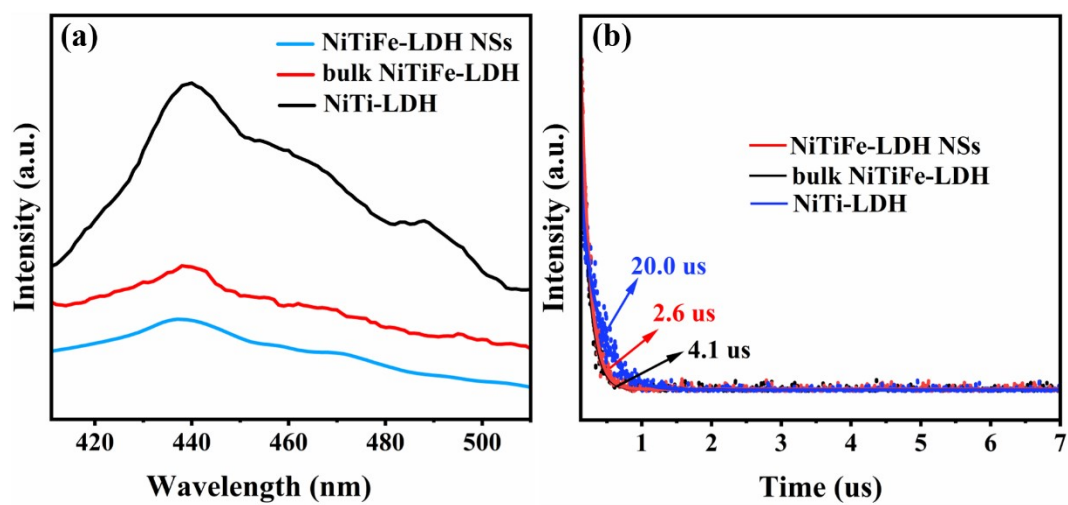


Fig. S8 Mott-Schottky plots for NiTiFe-LDH NSs

