

具有高效界面电荷转移的 0D/2D Bi₄V₂O₁₁/g-C₃N₄ 梯形异质结的设计合成及抗生素降解性能研究

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A 0D/2D Bi₄V₂O₁₁/g-C₃N₄ S-scheme Heterojunction with Rapid Interfacial Charges Migration for Photocatalytic Antibiotic Degradation

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Raw materials

Melamine ($C_3H_6N_6$, 99%), urea (CH_4N_2O , 99%), Ethylene glycol ($C_2H_8O_2$, 99.5%) and Bismuth (III) nitrate pentahydrate ($Bi(NO_3)_3 \cdot 5H_2O$, 99%) are purchased from Sinopharm Chemical Reagent Co., Ltd. Ammonium metavanadate (NH_4VO_3 , 99%) is purchased from Tianjin Kermel Chemical Reagent Co., Ltd. Oxytetracycline ($C_{22}H_{24}N_2O_9$, 98%) is purchased from Beijing InnoChem Science & Technology Co., Ltd. REACTIVE RED 2 ($C_{19}H_{13}Cl_2N_6NaO_7S_2$, 100%) is purchased from Shanghai Macklin Biochemical Co., Ltd. Ammonia solution (25%–28%) is purchased from Sichuan Xilong Scientific Co., Ltd. Ethanol (CH_3CH_2OH , 99.7%) is purchased from Tianjin Fuyu Fine Chemical Co., Ltd. Methanol (CH_3OH , 99.9%) is purchased from Tianjin Fuchen Chemical Reagent Factory. *Tert*-butyl alcohol (*t*-BuOH, 99%) is purchased from Tianjin Comio Chemical Reagents Co., Ltd. 1,4-benzoquinone (BQ, 99%) is purchased from Shanghai McLin Biochemical Technology Co., Ltd. Polyvinylidene fluoride (PVDF) and *N*-methylpyrrolidone (NMP) are purchased from Guangdong Candlelight New Energy Technology Co., Ltd. Potassium chloride (KCl, 99.5%) is purchased from Sinopharm Chemical Reagent Co., Ltd. Potassium ferrocyanide ($K_4Fe(CN)_6 \cdot 3H_2O$, 99.5%) and Potassium ferricyanide ($K_3Fe(CN)_6$, 99.5%) are purchased from Xi'an Chemical Reagent Factory.

Characterization

The powder X-ray diffraction (XRD) was recorded on Siemens D5005 Diffractometer with Cu K_α radiation ($\lambda = 1.5418 \text{ \AA}$). X-ray photoelectron spectroscopy (XPS) measurements were obtained on Thermo ESCALAB 250 XPS instrument equipped with a standard and monochromatic source (Al K_α $h\nu = 1486.6 \text{ eV}$). Transmission electron microscopy (TEM) images, high-resolution transmission electron microscope (HRTEM) images, elemental mapping and the selected area electron diffraction (SAED) patterns were taken on JEM-2100F microscope with an accelerating voltage of 200 kV. Scanning electron microscopy (SEM) images were carried out on XL30 ESEM FEG microscope. The N_2 adsorption-desorption isotherms were performed from a Micromeritics ASAP 2020 plus analyzer at 77.4 K. Photoluminescence (PL) spectra of the photocatalysts were obtained on FLSP920 Edinburgh Fluorescence Spectrometer. UV-vis diffuse reflectance spectra (UV-Vis DRS) were recorded by using Cary 500 spectrometer. Fourier transform infrared (FT-IR) spectra were collected by using a Spotlight 400 spectrometer. Electron paramagnetic resonance (EPR) spectroscopy tests were conducted on Bruker E580 Spectrometer at 293 K. Linear sweep voltammetry (LSV) curves, Mott-Schottky plots and electrochemical impedance spectroscopy (EIS) were measured by using standard three-electrode cell with platinum as counter, saturated calomel electrode as reference electrode and indium tin oxide (ITO) glass deposited with samples as working electrode.

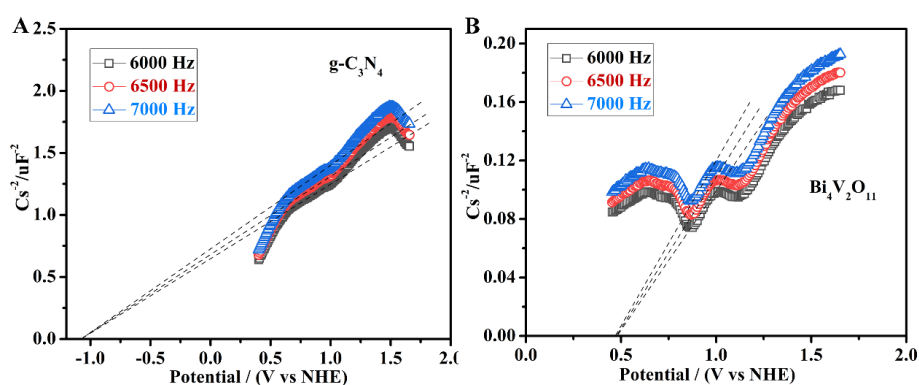


Fig. S1 The full Mott-Schottky plots of (A) $g\text{-C}_3\text{N}_4$ and (B) $Bi_4V_2O_{11}$ photocatalyst.

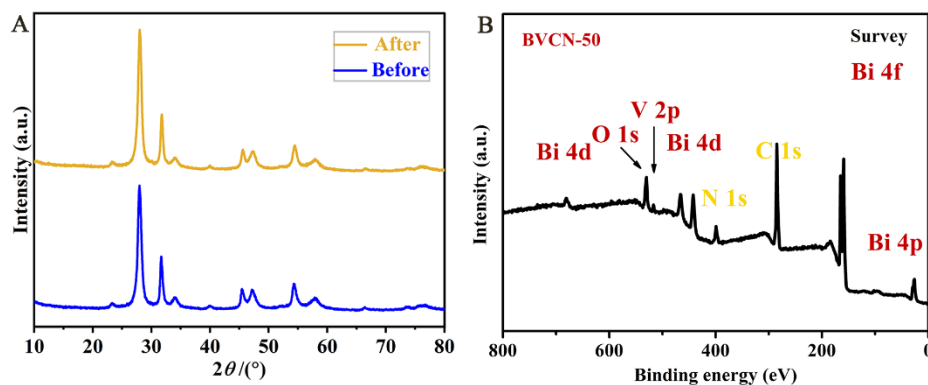


Fig. S2 (A) XRD and (B) XPS pattern of the reacted BVCN-50 photocatalyst.