

Synthetic BiOBr/Bi₂S₃/CdS Crystalline Material and Its Degradation of Dye under Visible Light

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Materials and Instruments

The chemicals involved were of analytical grade. Anhydrous ethanol (EtOH, C₂H₆O), ethylene glycol (EG, C₂H₆O₂), tert-butanol (TBA, C₄H₁₀O), potassium bromide (KBr) and potassium bromate (PB, KBrO₃) were purchased at Tianjin Chemical Reagent Sixth Factory. Bismuth nitrate (Bi(NO₃)₃•5H₂O), p-benzoquinone (p-BQ, C₆H₄O₂), thioacetamide (TAA, C₂H₅NS) and 5,5-dimethyl-1-pyrroline-N-oxide (DMPO, C₆H₁₁NO), were purchased from Shanghai Aladdin Biochemical Technology Co., Ltd. Cadmium chloride (CdCl₂) was purchased from Tianjin Damao Chemical Reagent Factory. Ammonium oxalate (AO, (NH₄)₂C₂O₄•H₂O) was purchased from Shanghai Macleans Biochemical Technology Co., Ltd. Methylene blue (MeB, C₁₆H₁₈ClN₃S) was purchased at Tianjin Guangfu Fine Chemical Research Institute.

The analytical instruments included UV762 (Shanghai Youke Instrument) ultraviolet/visible spectrophotometer (UV/Vis), Bruker Vertex 70 Fourier transform infrared spectrometer (FT-IR), Bruker D8 Discover X-ray powder diffractometer (XRD), Nano-SEM450LV Scanning electron microscopy (SEM), Octane Plus (EDAX, USA) X-ray energy spectrometer (EDS), ESCALAB 250Xi (Thermo Fisher Scientific, USA) X-ray photoelectron spectroscopy (XPS), U3900H (Hitachi, Japan) UV-Visible Diffuse Reflectance Spectrometer (DRS) and A300 (Bruker, Germany) electron paramagnetic resonance spectrometer (EPR).

Preparation of BiOBr Microspheres

BiOBr microspheres were prepared by a conventional solvothermal method[1]. In simple terms, 970.1 mg Bi(NO₃)₃•5H₂O was dispersed in 60 mL of ethylene glycol solution and stirred for 0.5 h until the solution was clear. Subsequently, 238 mg KBr was added to the above solution, and stirring was continued for 1 hour until the mixture was uniform. Next, the formed solution was transferred to a 100 mL Teflon reactor, and the reactor was placed at 140 °C over for 12 h. After the reaction, the white product was collected by centrifugation (5000 r/min), washed with deionized water and ethanol repeatedly and dried overnight in a vacuum drying oven at 60 °C.

Preparation of BiOBr/Bi₂S₃/CdS Composite

The preparation of BiOBr/Bi₂S₃/CdS ternary composites was mainly composed of precursor preparation and vulcanization[2]. First, 304.9 mg of synthetic BiOBr microspheres were dispersed in 40 mL of ethanol solution, and the ultrasound was continued for 0.5 h until the solution had no obvious precipitation. Then, 183.3 mg of CdCl₂ was added to the above solution and the ultrasonic treatment was maintained for 1 hour. After the treatment, transfer to magnetic stirring was arranged and continued at room temperature for

2 h. Then, 100 mg TAA was added to the mixed solution, and after stirring for 1 h, the solution was transferred to a 100 mL Teflon autoclave. After the reaction kettle was continuously heated at 160°C for 6 h, the product was collected by centrifugation, washed with deionized water and ethanol several times, and the final product was obtained in a vacuum drying oven at 60°C overnight. For comparison, pure Bi₂S₃ and CdS were developed following the same routine without the addition of BiOBr.

References

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