

Electronic Supplementary Information (ESI)

Preparation of Novel Carbon Nanofibers with BiOBr and AgBr Decorating for Photocatalytic Degradation of Rhodamin B

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Experimental Section

Materials: Polyacrylonitrile (PAN, $M_w = 150,000$) power, N, N'-dimethylformamide (DMF, AR), $\text{Bi}(\text{NO}_3)_3 \cdot 5\text{H}_2\text{O}$ (AR), BiCl_3 (AR), AgNO_3 (AR) and hexadecyl trimethyl ammonium Bromide (CTAB, AR) were purchased from aladdin Co. Ltd. (China) and were used as received without further purification.

Preparation of composite carbon nanofibers: Typically, PAN and BiCl_3 was firstly dissolved in DMF by mild stirring for 12 h to obtain a (PAN: 10 wt %, BiCl_3 : 5 wt%) homogeneous transparent solution. About 6 mL of the PAN/DMF solution was placed in a 10 ml syringe. The syringe was placed in a syringe pump that maintained a solution feeding rate of 0.1mm/h. A grounded metallic rotating roller covered with a piece of aluminum foil was used as collector, which rotated at 500 rpm. The distance between the needle tip and collector was 15 cm, and the voltage was set at 15 kV. Then, the as-prepared PAN composite nanofibers were transferred to a furnace with N_2 protection. The samples were firstly heated at 150 °C for 1h to remove the solvent and moisture. Then, the temperature was increased to 300 °C for 1.5 h and 500°C for 3h to carbonize. After cooling, the composite carbon nanofibers could be obtained.

Preparation of BiOBr/AgBr composite carbon nanofibers: $\text{Bi}(\text{NO}_3)_3 \cdot 5\text{H}_2\text{O}$ (0.6 g) was added to 60 mL 2-methoxyethanol. Then, AgNO_3 (0.1 g) and the CTAB (1.2 g) were added and stirred until a homogeneous solution obtained. The solution was transferred to a Teflon-lined stainless steel autoclave. The composite carbon nanofibers were immersed in the above solution. The solvothermal treatment was conducted at 160 °C for 24 h. After cooling, the as prepared sample was washed by water, and dried at 60 °C for

12 h to get the fine products. For the comparison, the BiOBr and BiOBr/AgBr catalysts were prepared by the solvothermal method in absence of AgNO₃ and/or composite carbon nanofibers.

Characterization

The microstructures and crystal phase of the as-prepared samples were analyzed with a SIEMENS Diffraktometer D5000 X-ray diffractometer with Cu K α radiation source at 35 kV, with a scan rate of 10° s⁻¹ in the 2 θ range of 10-80°. The ULTRA-55 field-emission scanning electron microscopy (FE-SEM) at an accelerating voltage of 10 kV and JSM-2100 transmission electron microscopy (TEM) were used to characterize the morphologies of the as-prepared samples. The UV-vis diffuse reflectance spectra were obtained for the dry-pressed disk samples using a UV-vis spectrometer (U-3010, Hitachi). X-ray photoelectron spectroscopy (XPS) data were obtained with an ESCALab220i-XL electron spectrometer from VG Scientific using 300W Al K α radiation. The base pressure was about 3 \times 10⁻⁹ mbar. The binding energies were referenced to the C1s line at 284.6 eV from adventitious carbon.

Measurement of photocatalytic activity

The photocatalytic activity of product was investigated by the photodegradation of RhB. The photodegradation experiments were carried out in a closed box. The radiation source was 500 W high-pressure Xenon lamp equipped with UV cutoff filter to provide visible light ($\lambda \geq 400$ nm) (model BL-GHX-V, Shanghai Bilon Instruments Factory, China). For the photocatalytic degradation of RhB, a piece of carbon nanofiber membranes (2.5 cm \times 7 cm) were immersed into 50 mL RhB (C₀ = 10 mg \cdot L⁻¹) aqueous solution with

constant stirring. Prior to irradiation, the suspensions were stirred in the dark for 30 min to ensure the adsorption-desorption equilibrium. The concentration of RhB was measured by JASCO V-570 UV-vis-NIR spectrophotometer (Japan). For the comparison, a blank experiment (without any catalysts) and a parallel test in the dark (with N-doped BiOBr/CFs) were carried out for indicating the adsorption of RhB under the same conditions.

Trapping experiments

The trapping experiments are similar to the photocatalytic activity test above except by the addition of 1mM IPA (a quencher of $\cdot\text{OH}$), 1mM BQ (a quencher of $\cdot\text{O}_2^-$) or 1 mM TEOA (a quencher of h^+) into the reaction system. For the comparison, a blank experiment and two catalytic experiments bubbled with N_2 and O_2 during the reaction are carried out as well. Conditions: RhB, $C_0 = 10 \text{ mg}\cdot\text{L}^{-1}$; Catalysts; BiOBr/AgBr hybrids composite carbon nanofibers, $\sim 2.5 \text{ cm}\times 7 \text{ cm}$ (10 mg); Light, 500 W, $\lambda \geq 400 \text{ nm}$; Time: 20 min.

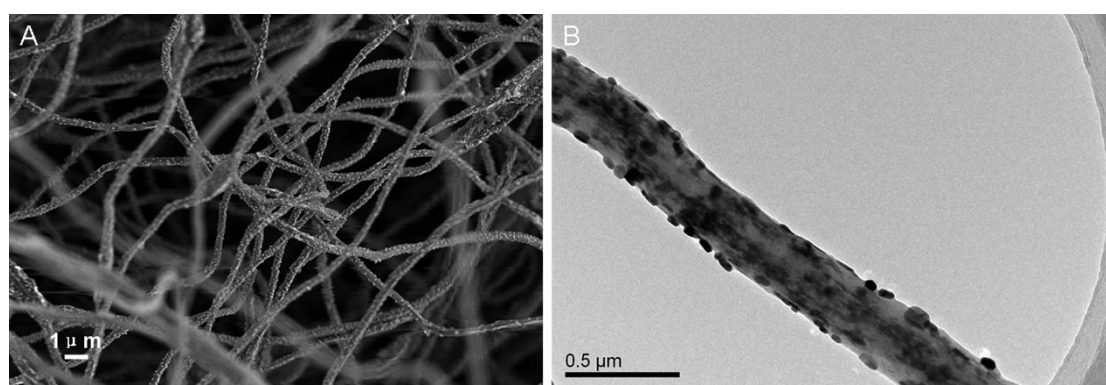


Fig. S1 SEM (A) and TEM (B) images of PAN and BiCl_3 composite nanofibers before carbonization.

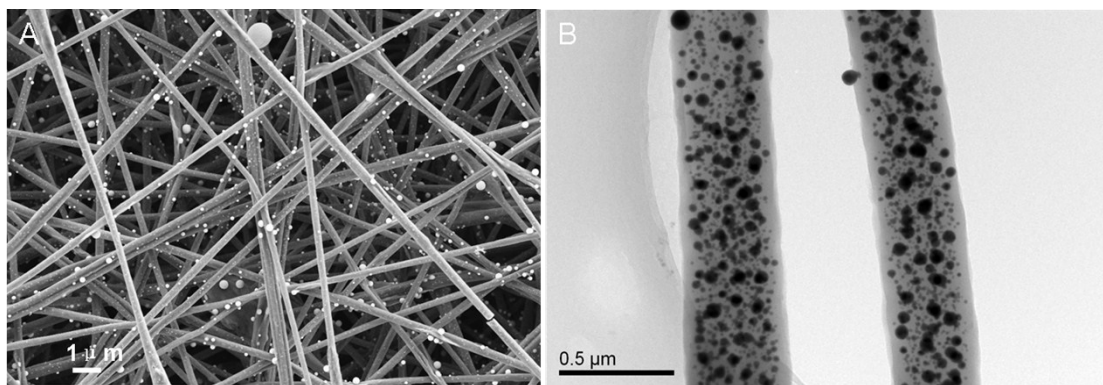


Fig. S2 SEM (A) and TEM (B) images of PAN and BiCl₃ composite nanofibers after carbonization.

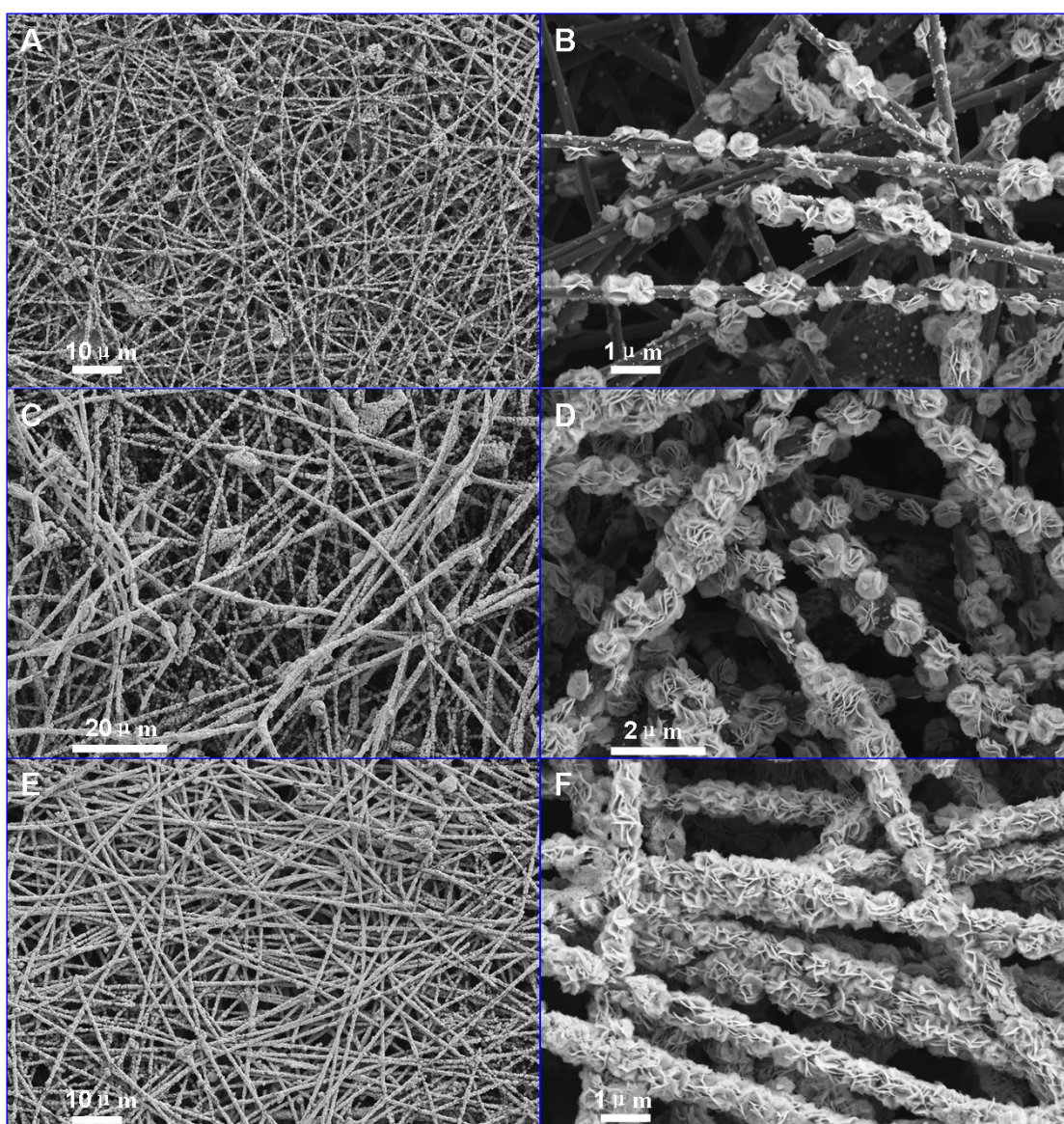


Fig. S3 SEM images of composite nanofibers after solvothermal treatment with different time (A and B: 30 min; C and D: 60 min; E and F: 180 min).

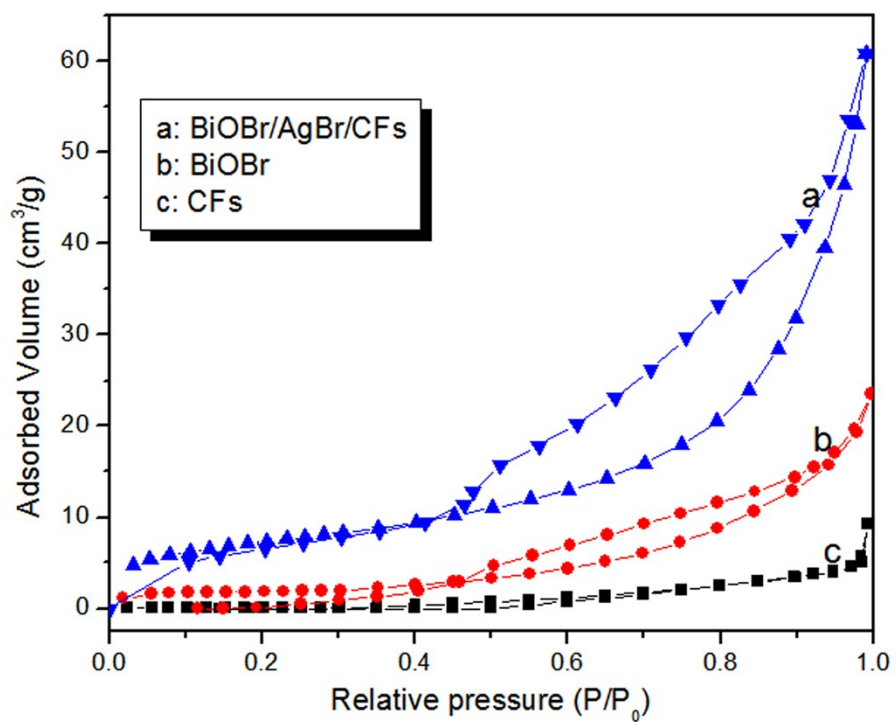


Fig. S4 N₂ adsorption–desorption isotherms curves (a: BiOBr/AgBr/CFs, b: BiOBr, c: CFs).