

Electronic Supplementary Information:

One-pot/self-template synthesis of mesostructured vanadium oxide embedded carbon nanofiber as a visible-light photocatalyst

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1. Experimental

1.1 Chemicals

Poly(acrylonitrile) (PAN, Mw = 150 000), poly(vinylpyrrolidone) (PVP, Mw = 1 300 000) and Ammonium metavanadate (NH_4VO_3) were purchased from Aldrich Chemical Co.,). N,N-Dimethylformamide (DMF), Degussa-P25 and Methylene blue (MB) were provided by Sinopharm Chemical Reagent Company. All the above materials were used without further purification.

1.2 Synthesis of mesostructured VO_x -CNFs (V-MCNF)

In a typical one-boat synthesis, NH_4VO_3 solution was prepared by dissolving 0.1 g NH_4VO_3 in 9.0 g DMF at 80 °C for 3 h with vigorous stirring to form purple solution, then 1.0 g PAN was added with continued stirring at the same temperature for 2 h to form yellowish homogenous solution. Afterward, the solution was cooled down to room temperature. PVP solution was prepared by dissolving 1.0 g of PVP in 9.0 g of DMF at the room temperature with vigorous

stirring for 30 min. The two solutions were mixed and stirring at room temperature for 2 h. The above viscous yellowish solution was drawn into a hypodermic syringe for electrospinning. The positive voltage applied to the tip was 15 kV and the distance between the needle tip and the collector was 20 cm. A dense web of membrane fibers was collected on the aluminium foil. To be carbonized, the substrates were first placed in a tube furnace and stabilized in air for 4 h at 250 °C. Then subjected to nitrogen gas at 800 °C at a ramp rate 5 °C /min, and finally cooled to room temperature. The obtained carbon nanofiber denoted as V-MCNF. Meanwhile, using the same method without adding NH_4VO_3 , pure carbon nanofiber was prepared and denoted as CNF.

1.3 Characterization of V-MCNF membrane

The scanning electron microscopy (SEM XL30, Philips, Netherlands) and transmission electron microscopy (TEM; high resolution TEM [HRTEM], JEM 2011, JEOL, Japan) were used to characterize the morphology of the products. X-ray diffraction (XRD) measurement was carried out using an X-ray diffractometer (D/MAX-rB, Rigaku, Japan). Ultraviolet-visible spectroscopy (UV-Vis) (UV-2450, Shimadzu, Japan). X-ray photoelectron spectroscopy (XPS) was performed on a RBD upgraded PHI-5000C ESCA system (Perkin Elmer) with Mg Ka radiation ($h\nu=1253.6$ eV). The concentrations of metal ions were measured by an Inductively Coupled Plasma Optical Emission Spectrometer (ICP-OES), (Optima 2100 DV, Perkin Elmer, USA). The nitrogen adsorption and desorption isotherms were measured at 77 K using an ASAP 2020 analyzer (ASAP 2020, Micromeritics Co., Ltd, USA). Surface areas were calculated by the Brunauer-Emmett-Teller (BET) method, and pore size distributions were calculated using the Barret–Joyner–Halenda (BJH) model. The concentrations of metal ions were measured by an Inductively Coupled Plasma Optical Emission Spectrometer (ICP-OES), (Optima 2100 DV, Perkin Elmer, USA).

1.4 Photocatalytic degradation tests.

Photocatalytic decomposition of the MB was carried out in a beaker containing a suspension of 10 mg of the photocatalyst sample in 30 ml MB solution ($20 \text{ mg} \cdot \text{l}^{-1}$) under visible-light irradiation. The visible light was obtained from 300W tungsten halogen lamp; the beaker was surrounded by the ice and water to avoid the heating effect. The solution was stirred in the dark for 30 min to obtain a good dispersion and reach adsorption–desorption equilibrium between the organic molecules and the catalyst surface. At a given interval of illumination, the samples of the reaction solution were taken out and analyzed by a Shimadzu UV/VIS (1700) spectrophotometer.

Result and discussion

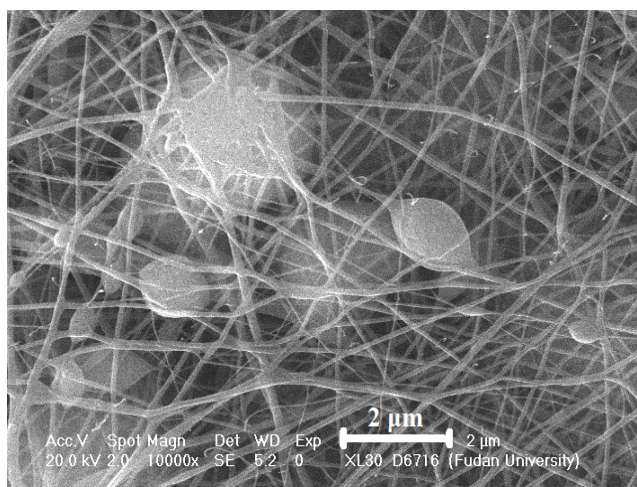


Fig. S1. SEM image of CNF with higher concentration of NH_4VO_3 (0.2 g), the vanadium oxide was not successfully embedded in CNF matrix, and resulted in aggregation on the carbon nanofiber.

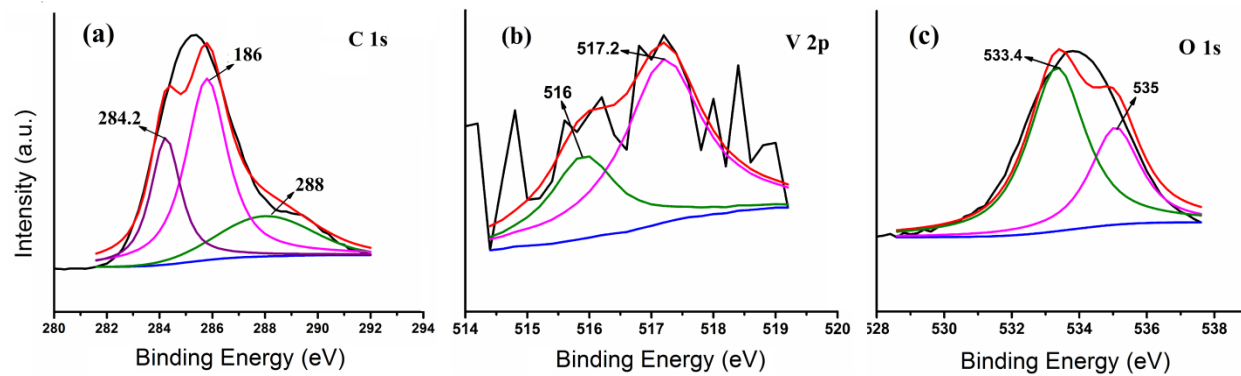


Fig. S2. (a) XPS spectra of C1s for the V-MCNF, (b) XPS spectra of V 2p for the V-MCNF and (c) XPS spectra of O1s for the V-MCNF.