Supplementary Materials

C fibers@MoO_2 nanoparticles core-shell composite: highly efficient solar-driven photocatalyst

Meng Wang,[1,2,3] Zhijian Peng,[1,2,*] Hong Li,[1,2,3] Zengying Zhao,[3] Xiuli Fu[2,*]

[1] *School of Engineering and Technology, China University of Geosciences, Beijing 100083, P.R. China*

[2] *School of Science, China University of Geosciences, Beijing 100083, P.R. China*

[3] *School of Science, Beijing University of Posts and Telecommunications, Beijing 100876, P.R. China*

*pengzhijian@cugb.edu.cn. Tel: 86-10-82320255; Fax: 86-10-82322624.

*xiulifu@bupt.edu.cn. Tel: 86-10-62282242. Fax: 86-10-62282242.

Financial support for this work from the National Natural Science Foundation of China (grant nos. 11674035 and 61274015) and the Fundamental Research Funds for the Central Universities is gratefully acknowledged.

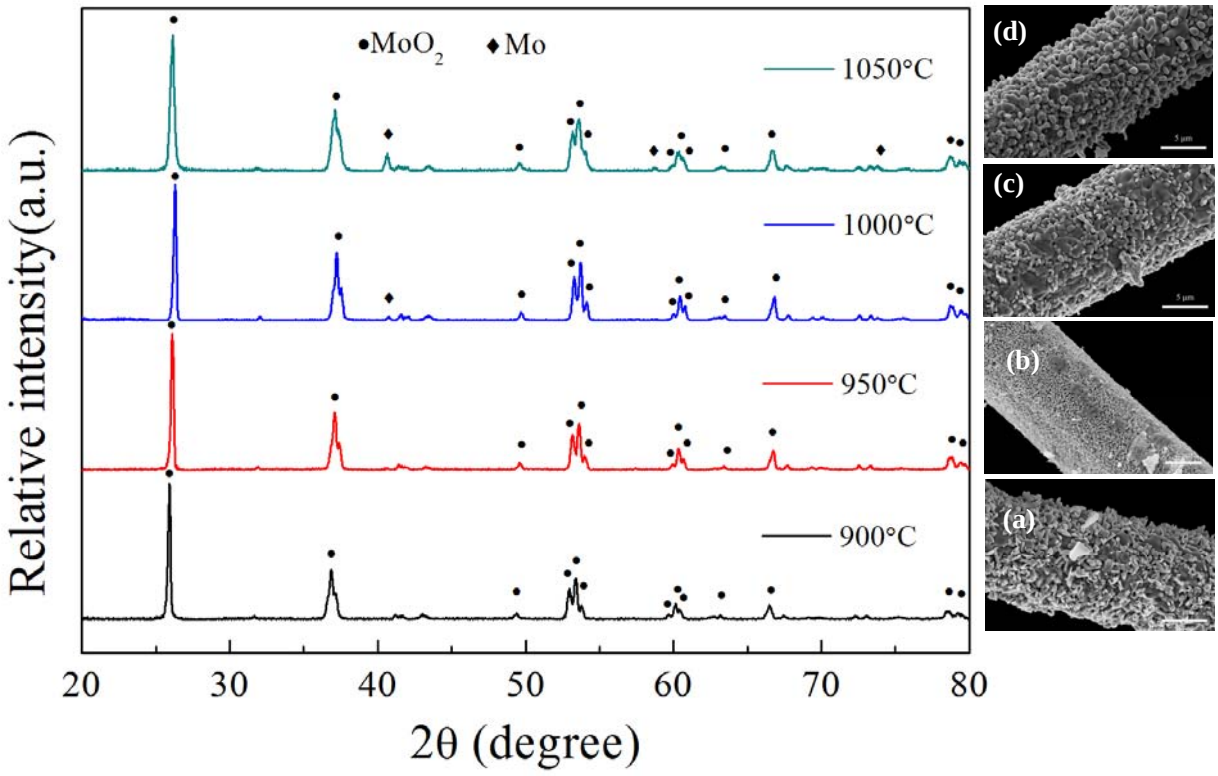

Fig. S1. Typical XRD patterns of the samples prepared at different temperatures and their corresponding SEM images: **(a)** 900, **(b)** 950, **(c)** 1000 and **(d)** 1050 °C. In this group of experiments, 1.0 g of MoO_3 powders was used.

From this figure, it can be seen that the samples prepared at 900 and 950 °C almost consisted of pure MoO_2 nanoparticles. As the temperature increased up to 1000 °C, a small amount of metallic Mo could be identified from the obtained samples.

Finally, 950 °C was selected to prepare the proposed C fibers@MoO_2 nanoparticles core-shell composite (C fibers@MoO_2 NPCSC).

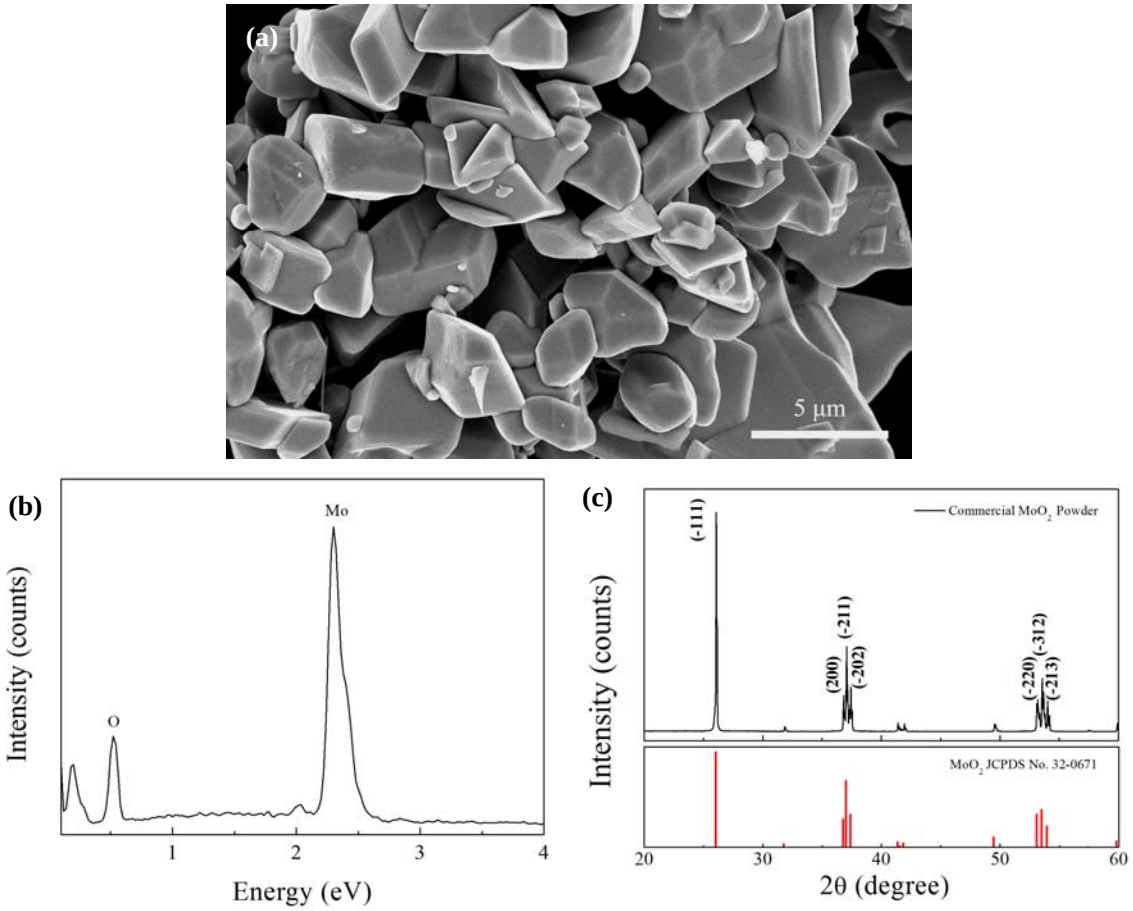

Fig. S2. Results on the commercially available MoO_2 powder. (a) Typical SEM image, indicating that the powder consists completely of nano-/micro-particles. (b) Typical EDX spectrum on the image area of Fig. S2a, revealing that the powder is composed of only Mo and O. (c) Typical XRD pattern of the sample, in which the diffraction peaks are matching well with those of MoO_2 phase (JCPDS card no. 32-0671). All these results reveal that the commercially available powder is composed of pure MoO_2 nano-/micro-particles.

Meng Wang, et al., *Journal of Materials Research*, Figure S3

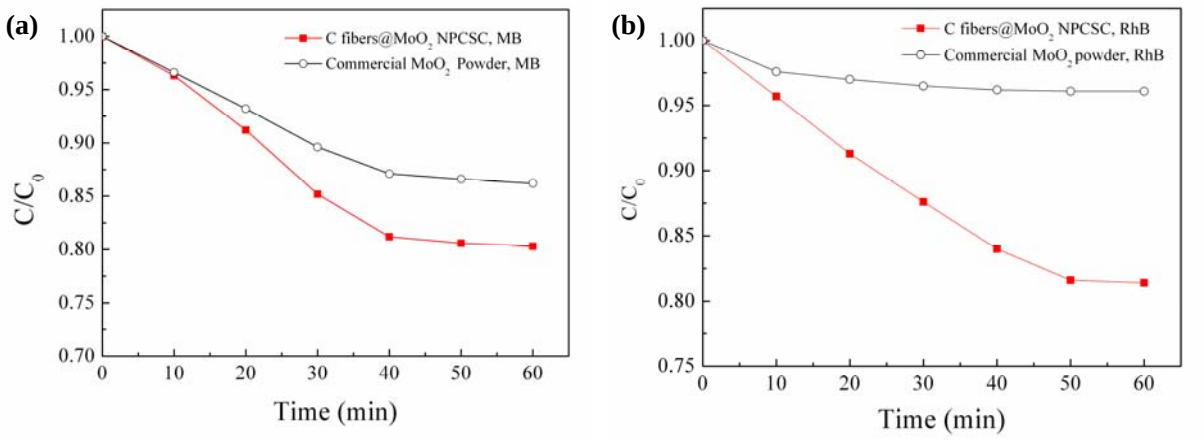

Fig. S3. Decolorization effects in the dark on methylene blue (a) and rhodamine B (b) over the as-synthesized C fibers@MoO_2 NPCSC, and commercially available MoO_2 powder. These results reveals that under the designed conditions, the adsorption-desorption equilibriums of methylene blue solution over both catalysts could be reached after about 40 min, while those of rhodamine B aqueous could be acquired after 10 min over the as-synthesized C fibers@MoO_2 NPCSC and 50 min over the commercially available MoO_2 powder. Moreover, after the equilibrium was reached, the C fibers@MoO_2 NPCSC presented significantly higher adsorption efficiency than the commercially available MoO_2 powder and C fibers.

Meng Wang, et al., *Journal of Materials Research*, Figure S4

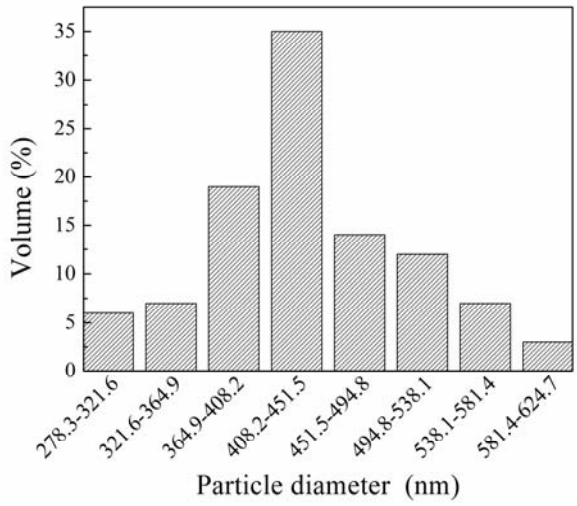

Fig. S4. Size distribution of MoO_2 nanoparticles in the as-prepared C fibers@MoO_2 NPCSC. The particle size distribution was evaluated by NanoMeaurer from the obtained SEM images. The calculated size of the MoO_2 nanoparticles was in the range of 280-620 nm with a mean value of approximately 410 nm. As can be seen from this figure, the size of MoO_2 nanoparticles presents a sharp normal distribution, having a quite uniform distribution around 410 nm.

Meng Wang, et al., *Journal of Materials Research*, Figure S5

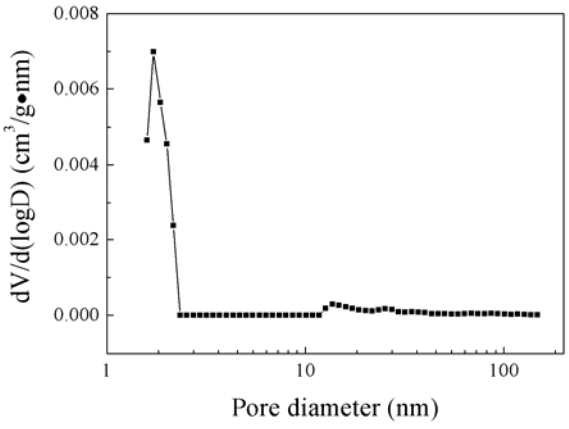

Fig. S5. Pore size distribution of the as-prepared C fibers@MoO_2 NPCSC. The pore size distribution curve was estimated by the Barrett-Joyner-Halenda (BJH) model. This figure confirms that the pores in the as-prepared C fibers@MoO_2 NPCSC distribute in a very narrow range, having a mean size around 3 nm.

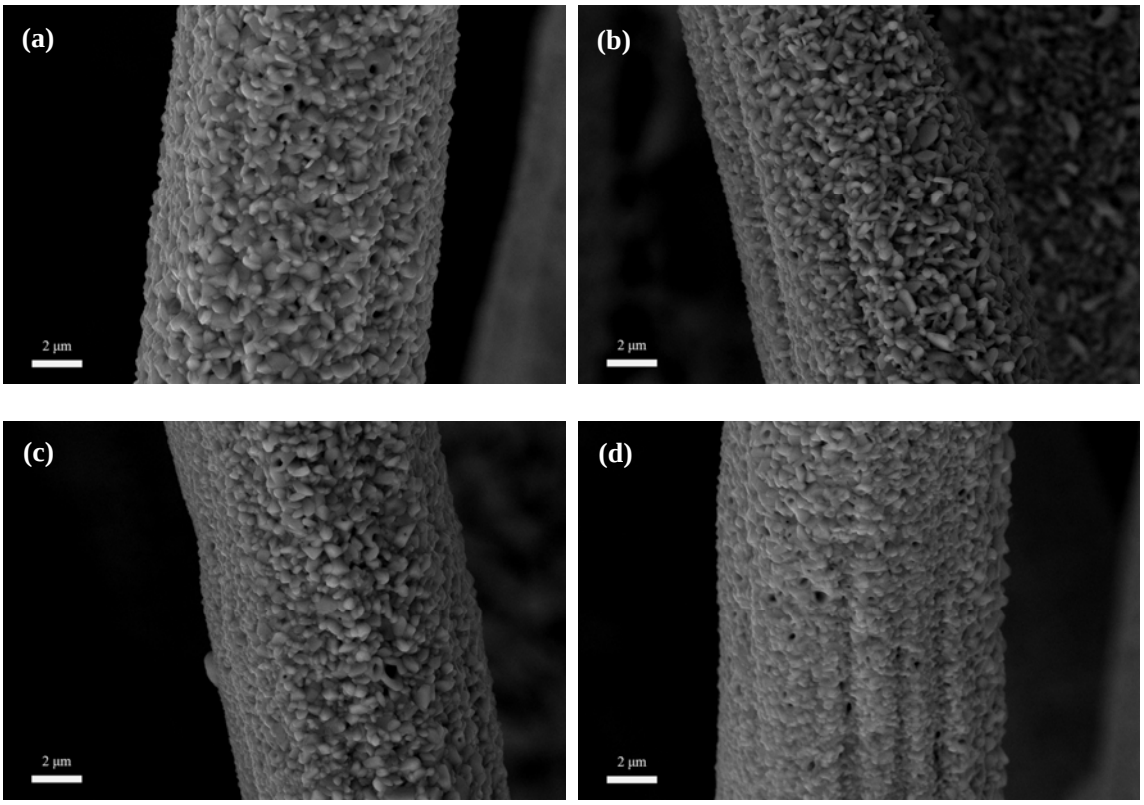

Fig. S6. Typical SEM images of the C fibers@MoO_2 NPCSC catalyst after being applied in the photodegradation of (a) methylene blue, (b) rhodamine B, (c) phenol and (d) potassium dichromate (Cr, VI) under simulated sunlight irradiation in more than one hour, respectively. In combination with its original morphology, it can be seen that after photocatalysis tests, most of the C fibers@MoO_2 nanoparticles core-shell composite catalyst still maintains its structure, indicating that the sample can be repeatedly applied.

Meng Wang, et al., *Journal of Materials Research*, Figure S7

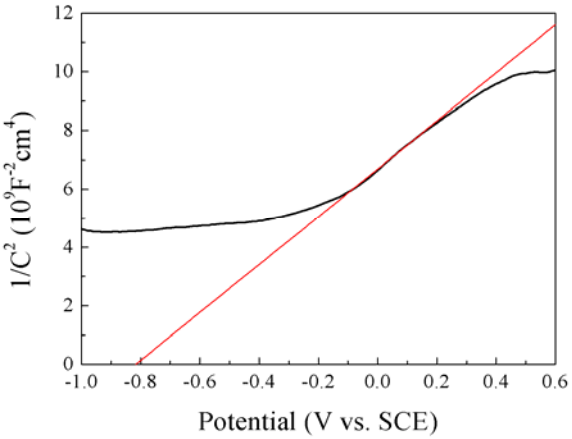

Fig. S7. Mott-Schottky plot of the as-prepared C fibers@MoO_2 NPCSC. The Mott-Schottky plot was recorded by CHI660E electrochemical workstation in a standard three-electrode system at a frequency of 1 kHz with 1 M Na_2SO_4 aqueous solution as the electrolyte, a wholly conducting FTO glass covered with the sample as the working electrode, a saturated calomel electrode as the reference electrode, and a Pt plate as the counter electrode, respectively. The experiment was conducted under a dark condition. From the Mott-Schottky plot, the flat band potential of MoO_2 in the as-prepared C fibers@MoO_2 NPCSC can be calculated as -0.8 V in saturated calomel electrode. After conversion into the reversible hydrogen electrode system, the conduction band potential of the as-prepared C fibers@MoO_2 NPCSC was calculated to be -0.14 V.