Supplementary Information

Photo-induced self-catalysis of nano-Bi_2MoO_6 for solar energy harvesting and charge storage

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Synthesis of nano Bi_2MoO_6

Powder samples of Bi_2MoO_6 were prepared by simple hydrothermal reaction. The precursors, Na_2MoO_4 •$2H_2O$ (2 mmol) and $Bi(NO_3)_3$•$5H_2O$ (2 mmol), were added into 20 ml of 2.0 M nitric acid with stirring , and the pH value of the solution was then adjusted to 2.0 by the addition of an ammonia solution. After being stirred for 2 h at room temperature, the mixed solution was transferred into a 50 ml Teflon-lined autoclave and kept at 453 K for 24 h. After cooling the solution to room temperature, the precipitates were separated by centrifuging, rinsed three times alternately with deionized water and ethanol, and then dried at 333 K for 24 h in a vacuum.

The preparation of the working electrodes

The active material, nano Bi_2MoO_6 powder, was mixed with conductive carbon black (Super P), and polyvinylidene fluoride binder (PVDF) solution (PVDF in N-methyl-2-pyrrolidinone (NMP)) at a weight ratio of 6:3:1 to form a slurry by stirring. Then the working electrodes were prepared by spreading the slurry on a hydrophilic carbon paper

using a doctor blade and then drying in vacuum at 80 °C for 24 h to remove the NMP. The mass loading density of Bi_2MoO_6 is uniform and is approximately 0.45 mg cm^{-2}.

The electrochemical and photoelectrochemical tests

The electrochemical processes of the Bi_2MoO_6 electrodes were measured using a standard three-electrode system, which contained the working electrode of Bi_2MoO_6, the platinum counter electrode, and the Hg/HgO reference electrode in a 1 M KOH electrolyte at room temperature and atmospheric pressure. Cyclic voltammetry (CV), galvanostatic charge-discharge (GCD), and electrochemical impedance spectroscopy (EIS 10 mHz to 100 kHz at voltage amplitude of 10 mV) tests were both performed on an IviumStat electrochemical workstation. The experimental measurements of the irradiation of visible light were carried out in a 100 ml quartz electrochemical cell. A 300 W Xenon arc lamp was utilized as a visible-light source. The focused intensity on the cell was ca. 8 $mWcm^{-2}$. In the sacrificial agent experiments, 0.01 M of triethanolamine (TEA) was added to the electrolyte as the hole sacrificial agent.

Materials characterization:

Rigaku-Ultima III X-ray diffractometer with CuKα radiation (λ = 1.5418 Å) was used to determine the phase formation of the as prepared materials. The surface morphological features of as-prepared samples were studied by using FE-SEM and TEM. The elemental detection was done by using energy-dispersive X-ray spectroscopy (EDS) analyzer.

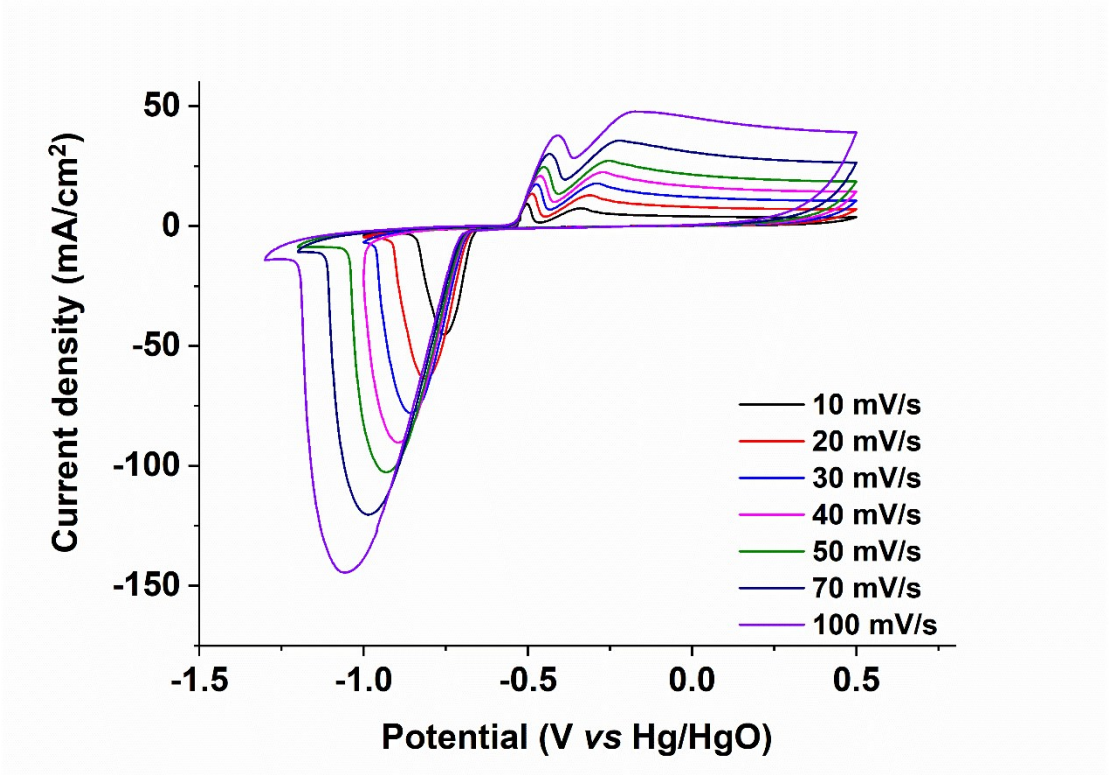

Figure S1. The CV curves of the Bi_2MoO_6 electrode at di□erent scan rates in the dark

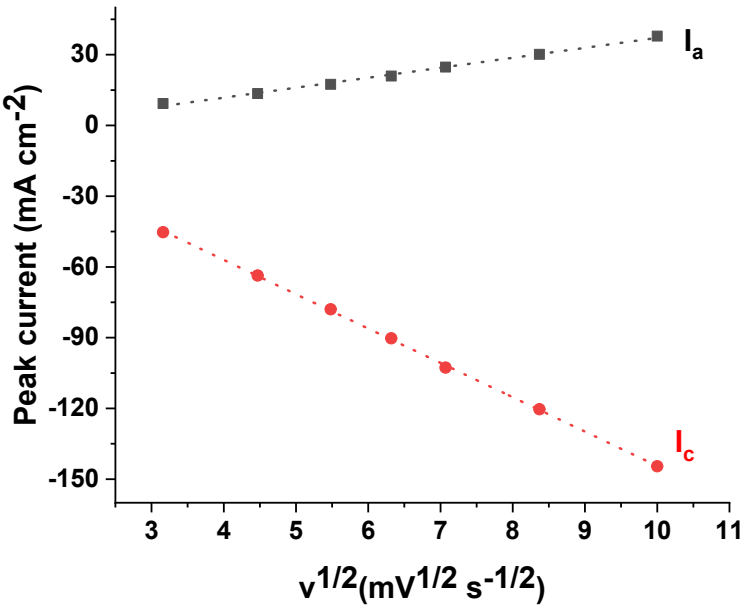

Figure S2. The relationship between the peak current and the sweep rate of the Bi_2MoO_6 electrodes (the currents of the anode and cathode were abbreviated as I_a and I_c, respectively).

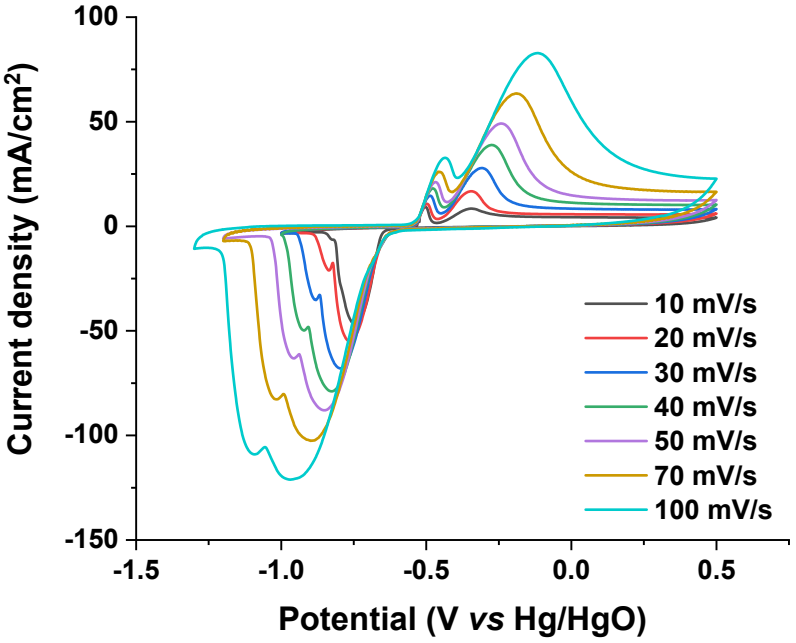

Figure S3. the CV curves of the Bi_2MoO_6 electrode at di□erent scan rates the irradiation of visible light

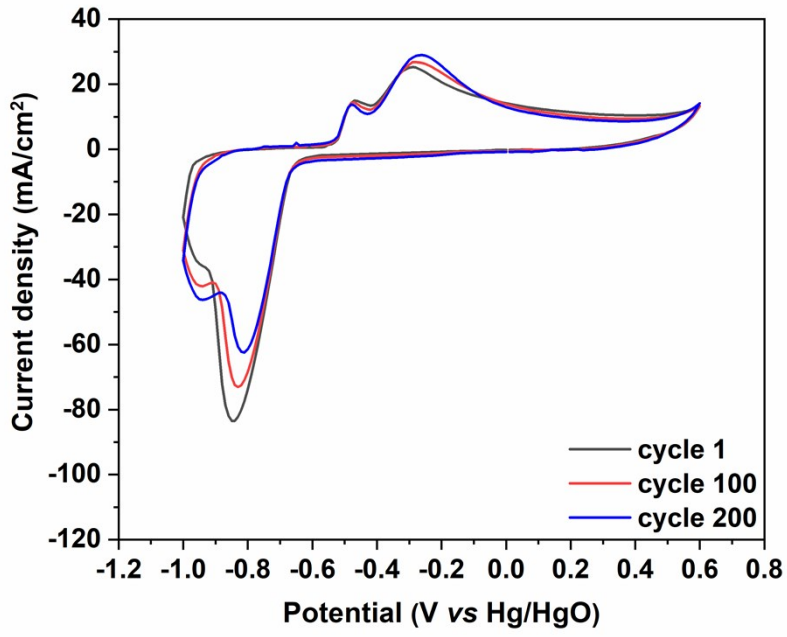

Figure S4. The CV curves of the Bi_2MoO_6 electrode cycling at a scan rate of 50 mV s^{-1} under the irradiation of visible light

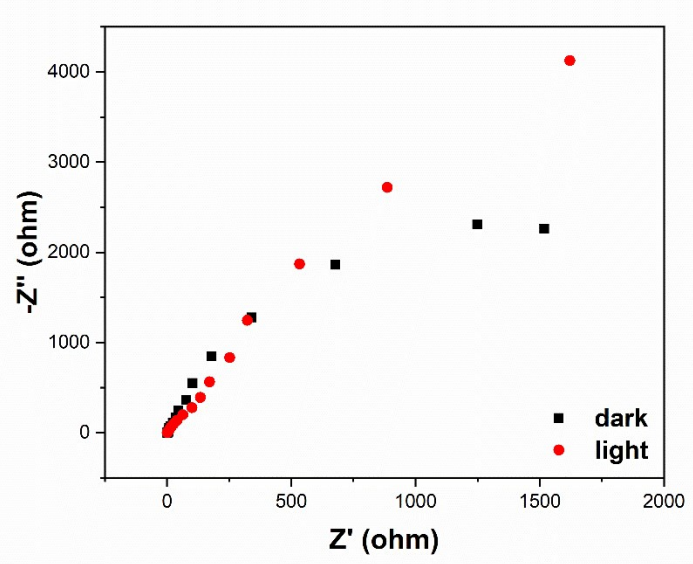

Figure S5 The Nyquist plots of the Bi_2MoO_6 electrode in the dark and under the irradiation of visible light

Table S1 The cycling stability comparison of Bi_2MoO_6-based electrode for supercapacitor application

Bi_2MoO_6-based electrode	Capacitance retention	Cycling number	Current density/ Scanning rate	Reference
BMO/TNT-3	76.7 %	1000	1 mA cm^{-2}	RSC Adv., 2019, 9, 4693
Bi_2MoO_6 nanoplates	66.7 %	200	10 mA cm^{-2}	Solid State Sci., 2014, 35, 18.
Bi_2MoO_6 nanowires	84.7 %	1000	10 mV s^{-1}	J. Electrochem. Soc., 2012, 159, D582
$Bi_{3.6}4O_{0.36}O_{6.55}$ NPs	35 %	100	2 A g^{-1}	J. Solid State Electr., 2016, 21, 403
Bi_2MoO_6 nanosheets	69.5%	1000	0.585 A g^{-1}	J. Power Sources, 2016, 331, 481
Hierarchical Bi_2MoO_6	92.4%	1000	0.585 A g^{-1}	J. Power Sources,

nanotubes				2016, 331, 481
Hierarchical Bi_2MoO_6 hollow microspheres	95%	400	3 A g^{-1}	ACS Sustain. Chem. Eng., 2018, 6, 7355
Bi_2MoO_6 illuminated by visible light	**92.5%**	**200**	**50 mV s^{-1}**	**This work**