# Supplementary Materials

# One-pot synthesis of bismuth sulfide nanostructures as an active electrode material for aqueous hybrid capacitors

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**Characterization**

Nitrogen gas sorption measurements were carried out with a NOVA 2000 gas sorption analyser (Quantachrome) at 77 K. The Brunauer-Emmett-Teller (BET) equation was used to the calculation of specific surface area ($S_{BET}$). The total pore volume ($V_T$) was determined through the amount of nitrogen adsorbed at a relative pressure of $p/p_0 = 0.96$. The Dubinin-Radushkevich equation was employed to the micropore volume ($V_{DR}$) estimation. The mesopore volume ($V_{mes}$) was calculated as the difference between the total pore volume and micropore volume. X-ray diffraction analyzer (Ultima IV, Rigaku equipped with a 2 kW X-ray tube using a Cu K$\alpha$2 radiation source) was used for XRD measurements under the following conditions: $\lambda = 0.1542$ nm, 40 kV tube voltage, 100 mA tube current, and scanning range of 10–80°. The field-emission scanning electron microscopy (FESEM, Merlin Zeiss) using accelerating voltage of 3 kV was applied to the $Bi_2S_3$ morphology observations. The chemical composition of each bismuth sulfide was determined by X-ray photoelectron spectroscopy (XPS) using a PHI 5000 VersaProbe (ULVAC-PHI) spectrometer. Survey spectra were acquired using a pass-energy of 117.4 eV, while high resolution spectra were acquired with a pass-energy of 23.5 eV. The sample charging was corrected using the C1s peak at 284.6 eV as an internal standard. The data analysis was performed using the CasaXPS software (version 2.3.19) after Shirley background subtraction.

**Electrochemical measurements**

The electrodes were fabricated with mass ratio of the component 80:10:10 of the bismuth sulfide as an active electrode material, polyvinylidene fluoride (PVDF) as a binder and carbon black as a percolator, respectively. The electrodes were pressed in the form of a pellet with a geometric surface area of 0.9 $cm^2$ and comparable mass of 5-7 mg. Electrochemical investigations were performed in a three-electrode Swagelok® setup using a 6 M KOH aqueous solution as an electrolyte, Hg|HgO reference electrode and gold current collectors to prevent corrosion, using a VSP Biologic potentiostat-galvanostat. In the three-electrode cell, the potential range of -1.1 V to 0 V versus a reference electrode was used. The electrochemical properties of the $Bi_2S_3$ samples were determined by cyclic voltammetry (CV) at a voltage scan rate from 1 to 100 mV $s^{-1}$ and galvanostatic charge-discharge (GCD) at current densities of 0.5-20 A $g^{-1}$.

Additionally, for the two-electrode hybrid setup, electrochemical impedance spectroscopy (EIS) measurements in the frequency range of 400 kHz to 10 mHz at an AC amplitude of 5 mV were performed with cycling stability tests using GCD at a current density of 1 A $g^{-1}$.