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Carbon-layer-encapsulated MOF-derived CoS_2 for Enhanced Sodium-Ion Storage

Xu Zhou ‡[a], Ruoheng Ding ‡[a], Dongdong Li [a], Junzhi Li *[b], Wei Han *[a]

[a] College of Physics, International Center of Future Science, Jilin University, Changchun 130012, China.

[b] School of Materials Science and Engineering, Key Laboratory of Materials Design and Quantum Simulation, Changchun University, Changchun 130022, China.

‡These authors contributed equally.

***Corresponding author:**

Junzhi Li, lijz91@ccu.edu.cn; Wei Han, Whan@jlu.edu.cn

Experimental section

Characterization: The microstructural characteristics of the samples were investigated using a scanning electron microscope (SEM, Magellan 400) and a transmission electron microscope (Tecnai G2 F30 S-TWIN). Raman spectroscopy (Renishaw inVia) was conducted to assess the extent of carbon defects within the samples. The crystal structure of the materials was examined using a powder diffractometer (Rigaku D/MAX 2550 V). The active material content was quantified using a simultaneous thermal analyzer (NETZSCH STA 449 F5 Jupiter, DSC/DTA-TG). Additionally, X-ray photoelectron spectroscopy (Thermo Fisher NEXSA) was applied to determine the oxidation states of the constituent elements.

Electrochemical measurements: Electrochemical evaluations were performed using CR2032-type coin cells on a LAND CT2001A electrochemical workstation. The counter electrode employed was a sodium foil with a diameter of 14 mm. The electrolyte solution consisted of 1 mol/L sodium perchlorate ($NaClO_4$) dissolved in a solvent mixture of ethylene carbonate (EC) and diethyl carbonate (DEC) in a 1:1 volume ratio, supplemented with 5 wt% fluoroethylene carbonate (FEC). The working electrode was prepared from a slurry containing 70 wt% active material, 20 wt% conductive additive, and 10 wt% binder. The mass loading was determined from the weight difference between the coated electrode and an uncoated copper foil of the same dimensions. The average areal loading of the active material on the electrode sheet was calculated to be 1.2 mg cm^{-2}.

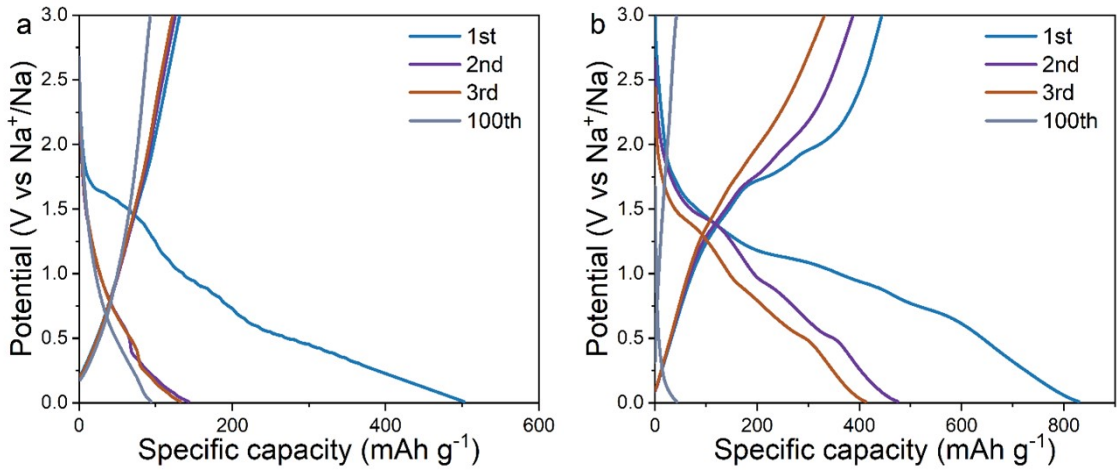

Fig. S1 (a) GCD curves of ZIF-Co at 0.1 A g^{-1}. (b) GCD curves of ZIF-CoS_2 at 0.1 A g^{-1}.

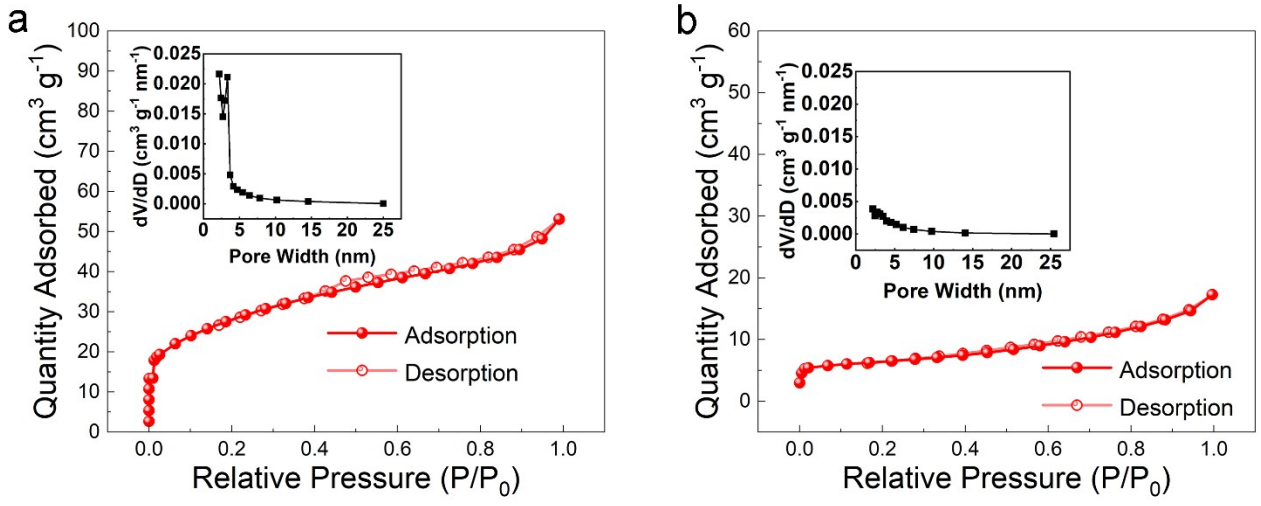

Fig. S2 Nitrogen adsorption-desorption isotherms and the corresponding pore-size distribution curves (inset) of (a) ZIF-CoS_2 and (b) C@ZIF-CoS_2.