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Preparation of carbon coated MoS_2 flower-like nanostructure with self-assembled nanosheets as high-performance lithium-ion battery anodes

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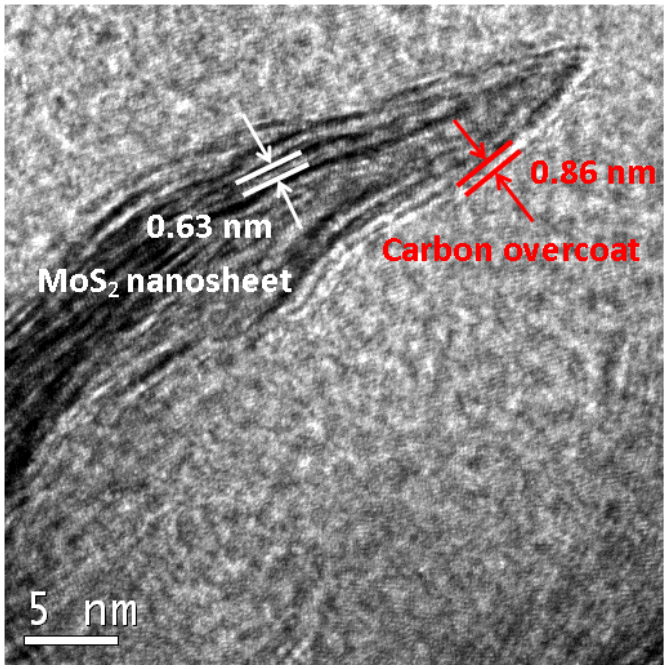

Figure S1. TEM image of the C@MoS_2 (2:1) composites demonstrates the MoS_2 nanosheet with a carbon-coated shell.

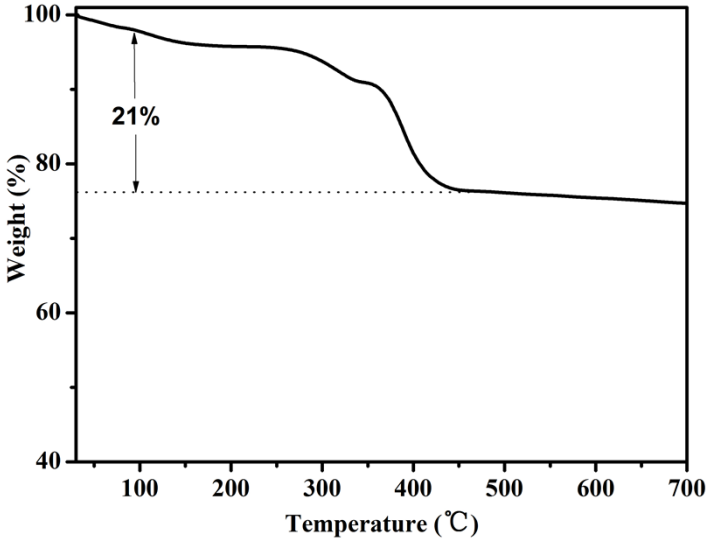

Figure S2. TGA curve of the C@MoS_2 (2:1) composites at 5°C min^{-1} in air.

The first weight loss below 100 °C is mostly attributed to water evaporation. So the weight was normalized at 100 °C. The weight gain from 300 °C to 400 °C is due to the oxidation of MoS_2 to MoO_3. The other weight loss occurs at approximately 400 °C, caused by the combustion of the carbon. The weight fraction of MoS_2 in the initial sample can be easily estimated to be about 83.3% by assuming that the remaining product after TGA is pure MoO_3 at 400 °C.

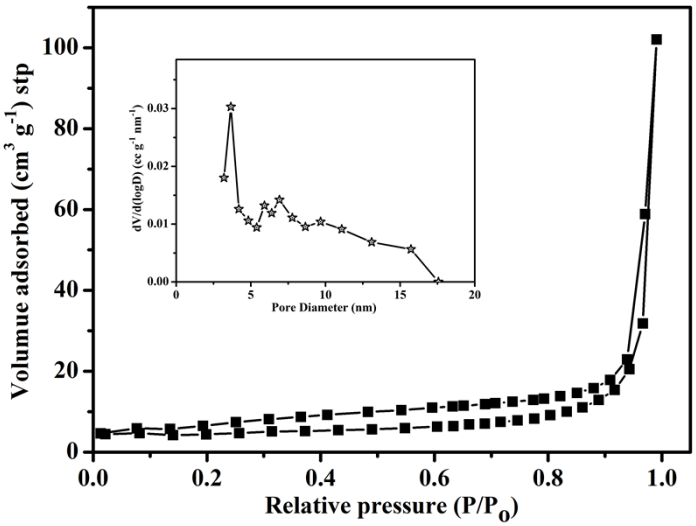

Figure S3. The N_2 adsorption-desorption isotherm of the prepared C@MoS_2 (2:1). Insert: The corresponding pore size distribution.

N_2 adsorption/desorption measurement shows that the C@MoS_2 (2:1) composites possess a Brunauer-Emmett-Teller (BET) specific surface area of ca. 31 $m^2\ g^{-1}$, and pore size mainly centered at 4 nm, which is in the mesoporous range.

The average particle size of the C@MoS_2 (2:1) is estimated to be 50 nm. The density of MoS_2 is 5.06 g cm^{-3}. Gas-adsorption derived surface areas (31 $m^2\ g^{-1}$) are higher than the calculated surface areas (24 $m^2\ g^{-1}$). The increase in surface area with increasing carbon content is attributed to the porous nature of amorphous carbon.

$$S = \pi d^2 = 3.14 * \left(5 * 10^{-6}\right)^2 = 7.85 * 10^{-11}\ cm^2$$

$$V = \frac{\pi d^3}{6} = \frac{3.14 * (5 * 10^{-6})^3}{6} = 6.54 * 10^{-17}\ cm^3$$

$$S_w = \frac{S}{\rho V} = \frac{7.85 * 10^{-11}}{5.06 * 6.54 * 10^{-17}} = 23.7\ m^2 g^{-1}$$