Support information

Conductive Molybdenum Carbide as the Polysulfide Reservoir for Lithium Sulfur Batteries

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Fig. S1 EDS result of Mo$_2$C nanosheets.
Fig. S2 TGA curves of Mo$_2$C in air atmosphere with a heating rate of 10 °C min$^{-1}$

and XRD pattern of MoO$_3$. 
**Fig. S3** A custom-built 4-point probe measurement of the electronic conductivity for Mo$_2$C.

The sheet resistance (Rs) of the Mo$_2$C sample is 0.11Ω/□, which tested by the four-point probe technique at room temperature. The thickness (t) of the Mo$_2$C sample determined by a micrometer is 3 mm. The electronic conductivity (C) of the sample is calculated by the following formula:

$$C = \frac{1}{Rs \times t \times 10^{-3}} = \frac{1}{0.11 \times 3 \times 10^{-3}} = 3 \times 10^3 \text{ S m}^{-1}$$
Fig. S4 Comparison of XPS spectra of element Mo in (a) pure Mo$_2$C and (b) Mo$_2$C/Li$_2$S$_6$ composites.
Fig. S5 Raman spectra of representative (a) Li$_2$S$_6$ and Mo$_2$C / Li$_2$S$_6$, (b) Mo$_2$C and Mo$_2$C/Li$_2$S$_6$ to highlight the interaction.
Fig. S6 SEM image and corresponding EDX elemental mappings of Mo, S and C elements in the S@Mo$_2$C composite.
Fig. S7 TGA curves of S@Mo$_2$C in N$_2$ atmosphere with a heating rate of 10 °C min$^{-1}$. 
Fig. S8 Electrochemical impedance spectroscopy of 2Mo2C/8S, 3Mo2C/7S, 4Mo2C/6S and C/S electrode.
Fig. S9 (a) Specific capacity and (b) Areal capacity of \( \text{Mo}_2\text{C} \) at 0.1 C with a high sulfur loadings of 4.68 mg cm\(^{-2}\).
**Table S1.** Electrical conductivity of different sulfur host materials.

<table>
<thead>
<tr>
<th>Materials</th>
<th>TiO&lt;sub&gt;2&lt;/sub&gt;</th>
<th>Nb&lt;sub&gt;2&lt;/sub&gt;O&lt;sub&gt;5&lt;/sub&gt;</th>
<th>XC-72 carbon</th>
<th>TiN</th>
<th>This work</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conductivity (×S cm&lt;sup&gt;-1&lt;/sup&gt;)</td>
<td>10&lt;sup&gt;-10&lt;/sup&gt;</td>
<td>10&lt;sup&gt;-6&lt;/sup&gt;</td>
<td>1.5</td>
<td>46</td>
<td>30</td>
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