Supplementary Materials

Effect of Sulfur Doping on Structural Reversibility and Cycling Stability of Li$_2$MnSiO$_4$ Cathode Material

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Figures:

**Fig. S1** The XRD patterns of Li$_2$MnSiO$_{4-x}$S$_x$/C ($x = 0$, 0.01, 0.02, 0.03, 0.05 and 0.07) samples.
Fig. S2 SEM images of (a) P-LMS and (c) S1-LMS samples. The particle size distribution of (b) P-LMS and (d) S1-LMS samples.

Fig. S3 TG curves of P-LMS and S1-LMS samples in the range of 50-600 °C at 10 /min rate in air.
**Table S1** $I_D/I_G$ value of P-LMS and S1-LMS samples before/after cycling.

<table>
<thead>
<tr>
<th>Samples</th>
<th>before cycle</th>
<th>after first charge</th>
<th>after first discharge</th>
</tr>
</thead>
<tbody>
<tr>
<td>P-LMS</td>
<td>0.44</td>
<td>0.59</td>
<td>0.71</td>
</tr>
<tr>
<td>S1-LMS</td>
<td>0.42</td>
<td>0.56</td>
<td>0.66</td>
</tr>
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</table>

**The details of EIS fitting and calculation.**

EIS was performed to explore the effect of S doping on reaction kinetic. The collected plots are consist of a semicircle in the high frequency region and a straight line in the low frequency region (Fig. 7c, d). The semicircle diameters are associated with the charge transfer resistance ($R_{ct}$) and the straight lines correspond to the lithium ion...
diffusion process. The slope of the inclined line (insets) is Warburg factor ($\sigma$). The lithium ion diffusion coefficient ($D_{Li^+}$) is calculated by following equation:

$$D = \frac{R^2 T^2}{2A^2 n^4 F^4 C^2 \sigma \frac{2}{\omega}}$$

R is the gas constant (8.314 J mol$^{-1}$ K$^{-1}$), T is the absolute temperature (298.15 K), A is the area of cathode electrode (0.95 cm$^2$ in our work), n is the number of electrons (2 in theory), F is the Faraday constant (96485 C·mol$^{-1}$), C is the molar concentration of lithium ion (0.0098 mol·cm$^{-3}$) and $\sigma$ is the Warburg coefficient. The fitting results and calculations are displayed in Table 2.