Supporting Information

F-doped carbon nano-onion film as scaffold for highly efficient and stable Li metal anode: A novel laser direct-write process

Dhanya Puthusseri,* Malik Wahid, Aniruddha Basu, Rohit Babar, Mukul Kabir,* and Satishchandra Ogale*

Figure S1. (a) XPS survey spectrum for F-CNOF. High resolution XPS spectra for (b) C1s, (c) F1s and (d) O1s
Figure S2. (a) Comparison of the overpotential for Li plating on Cu foil and F-CNOF for 1st cycle (b) and first two plating and stripping cycles

Figure S3. Charge discharge curve of first three cycles for F-CNOF in Li half-cell at current density of 0.05 mA cm$^{-2}$
Figure S4. (a) Comparison of the voltage profile and (b) Coulombic efficiency for the plating/stripping cycles of F-CNOF and Cu foil.

Figure S5. (a) Voltage-time profile and (b) Coulombic efficiency and cyclic stability for the plating/stripping cycles of F-CNOF in LiPF$_6$ EC:DMC electrolyte.
Figure S6. Rate performance of Cu foil at different current densities 1, 2, 4 and 6 mA cm$^{-2}$ respectively and (b) Coulombic efficiency comparison of Cu foil and F-CNOF for the rate performance.

Figure S7. Comparison of voltage hysteresis of F-CNOF and Cu foil at different current densities 1, 2 and 4 mA cm$^{-2}$. 
Figure S8. Voltage-time profile of F-CNOF for plating/stripping cycles for capacities (a) 5 mAh cm\(^{-2}\) and (b) 10 mAh cm\(^{-2}\) at current density of 1 mA cm\(^{-2}\). Coulombic efficiency plots for different capacities (c) 5 mAh cm\(^{-2}\) and (d) 10 mAh cm\(^{-2}\).

Table S1: Summary of specific capacity obtained for different plating/stripping capacities on the basis of carbon loading and total loading including lithium

<table>
<thead>
<tr>
<th>Total Plated/Stripped Capacity (mAh)</th>
<th>Area Capacity (mAh cm(^{-2}))</th>
<th>Loading of F-CNOF on Cu foil (mg)</th>
<th>Li loading (mg)</th>
<th>Specific Capacity on the basis of F-CNOF weight (mAh g(^{-1}))</th>
<th>Specific Capacity on the basis of total weight (mAh g(^{-1}))</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>2.66</td>
<td>0.8</td>
<td>1.03</td>
<td>5000</td>
<td>2185</td>
</tr>
<tr>
<td>7.5</td>
<td>5</td>
<td>0.8</td>
<td>1.93</td>
<td>9375</td>
<td>2747</td>
</tr>
<tr>
<td>15</td>
<td>10</td>
<td>0.8</td>
<td>3.86</td>
<td>18750</td>
<td>3218</td>
</tr>
</tbody>
</table>
Figure S9. (a) Comparison of Nyquist plots obtained from the EIS measurement of F-CNOF electrode and Cu foil at different stages of plating/stripping (b) Magnified in the high frequency region

Figure S10. X-ray diffraction patterns of fresh F-CNOF, F-CNOF before and after plating.
Figure S11. Surface morphologies of the F-CNOF electrodes after plating (a) 2.6 mAhcm$^{-2}$ and (b) 5 mAhcm$^{-2}$.

Figure S12: Charge-discharge cycling performance of the full cell with LTO as the positive and F-CNOF|Li as the negative electrode.