

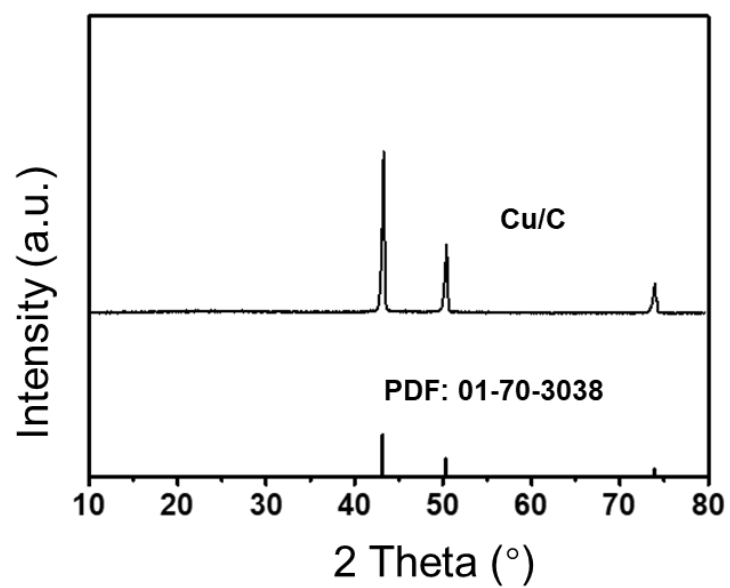
## **Supporting Information**

### **Chitosan derived carbon matrix encapsulated CuP<sub>2</sub> nanoparticles for sodium-ion storage**

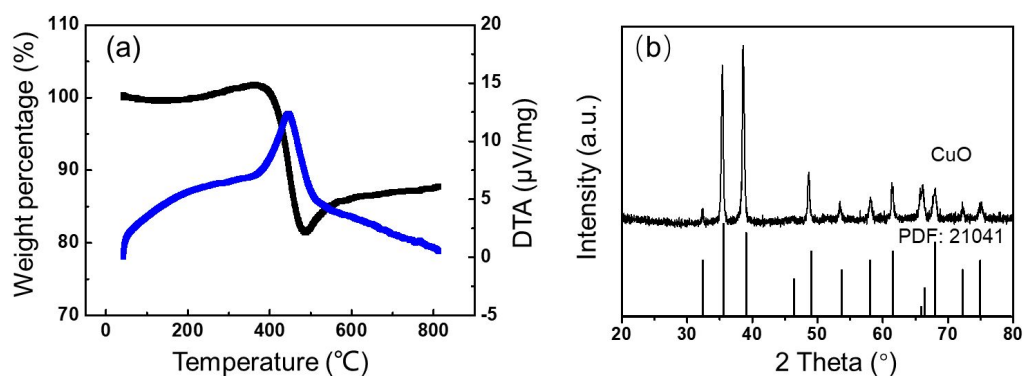
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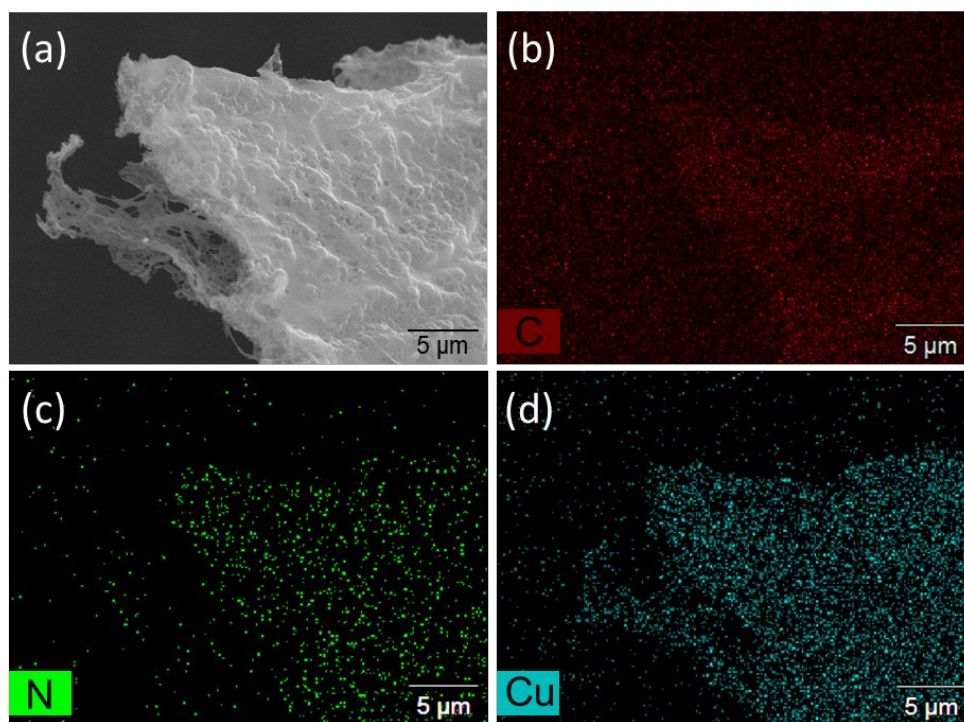
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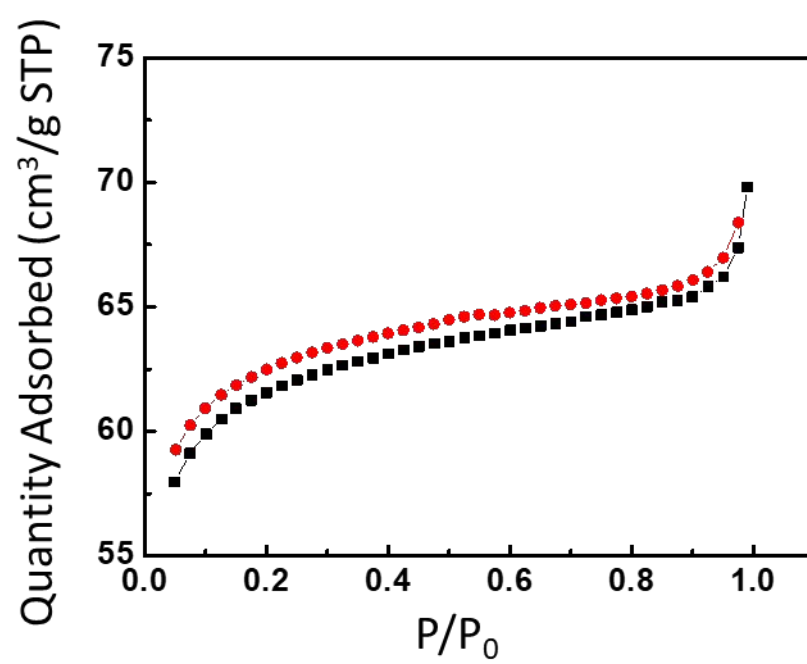
**Figure S1.** XRD pattern of the Cu/C monolith.



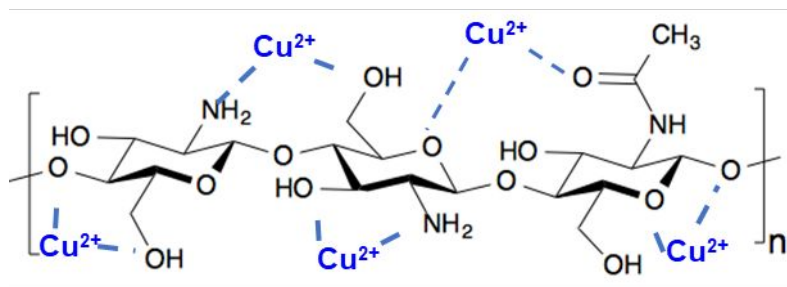
**Figure S2.** (a) Thermogravimetric and differential thermal analysis (TG/DTA) curves of the Cu/C composite testing in air atmosphere at temperature in the range of 30 to 800 °C. (b) XRD pattern of Cu/C composite after TG/DTA test, which reveals that the Cu/C composite turns to CuO after test. Carbon content is calculated to be 30.4%.



**Figure S3.** (a-d) SEM and corresponding EDX images of the Cu/C composite. Elemental Cu is uniformly dispersed in the carbon matrix. Nitrogen (N) is also detected since chitosan is a linear polysaccharide composed a substantial amount of acetylated units.

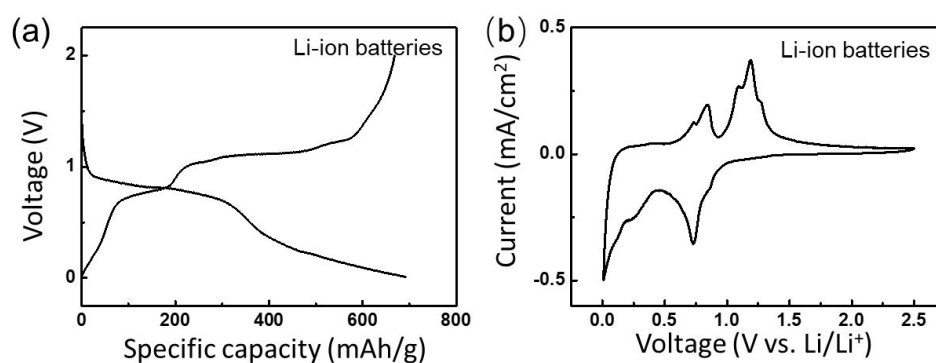


**Figure S4.** N<sub>2</sub> adsorption isotherm of CuP<sub>2</sub>/C composite.

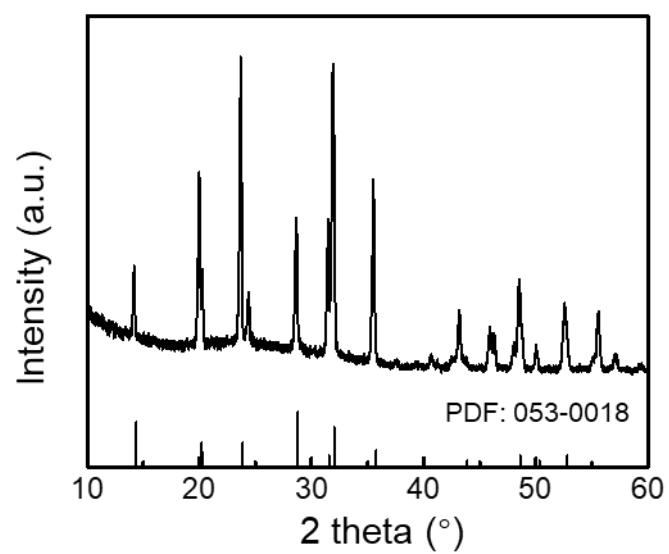


**Figure S5.** A schematic graph of the interaction between the chitosan and Cu<sup>2+</sup>.

For lithium-ion half cell evaluation, lithium foil is used as both counter and reference electrode, 1 M solution of  $\text{LiPF}_6$  in a mixture of EC and Diethyl carbonate (DEC) (1:1 by volume) with 5 vol% addition of FEC as electrolyte and with celgard 2400 as separator.

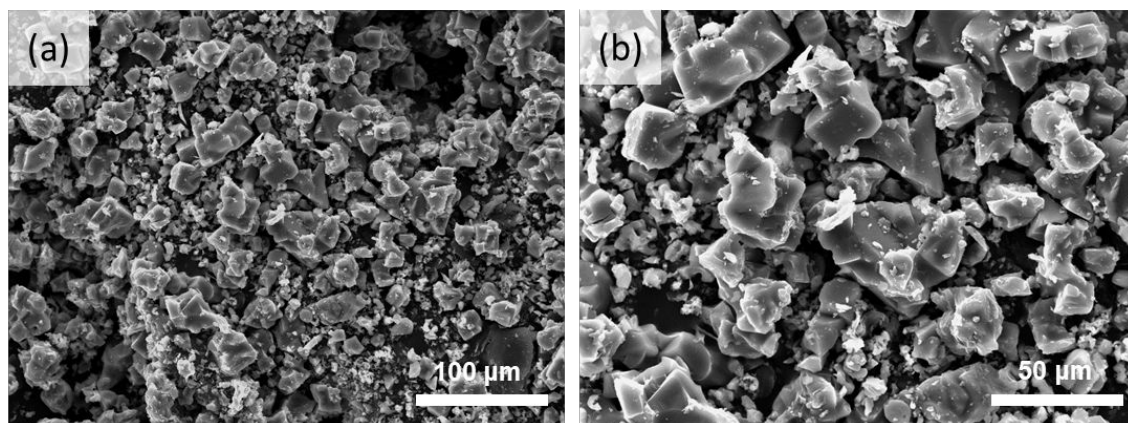


**Figure S6.** (a) charge/discharge profiles and (b) CV curve of the  $\text{CuP}_2/\text{C}$  composite as anode in lithium-ion batteries.

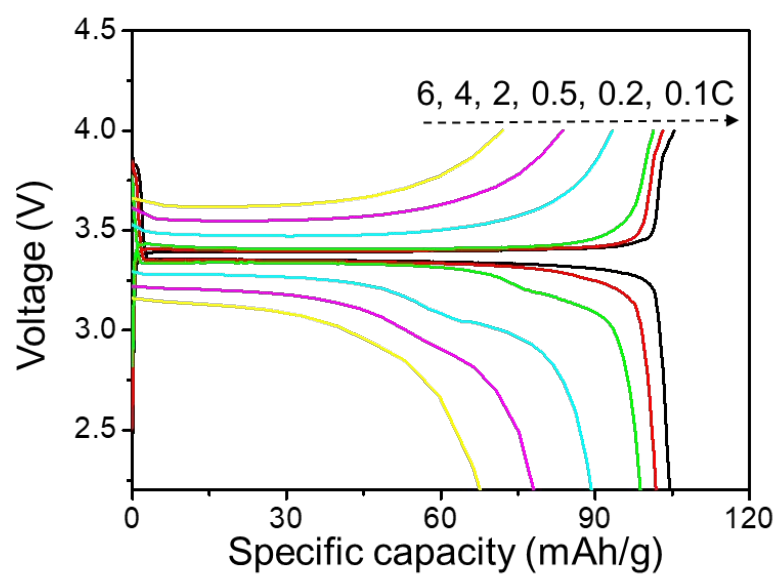


**Figure S7.** XRD result of the NVP cathode.





**Figure S8.** SEM images of the NVP cathode.



**Figure S9.** Charge/discharge profiles of NVP electrode in NVP | Na half cell at different current rates at voltage ranging from 2.2-4.0 V.