

## Supporting information

### **Boosting capacitive sodium ion storage in electrochemically exfoliated graphite for sodium ion capacitors**

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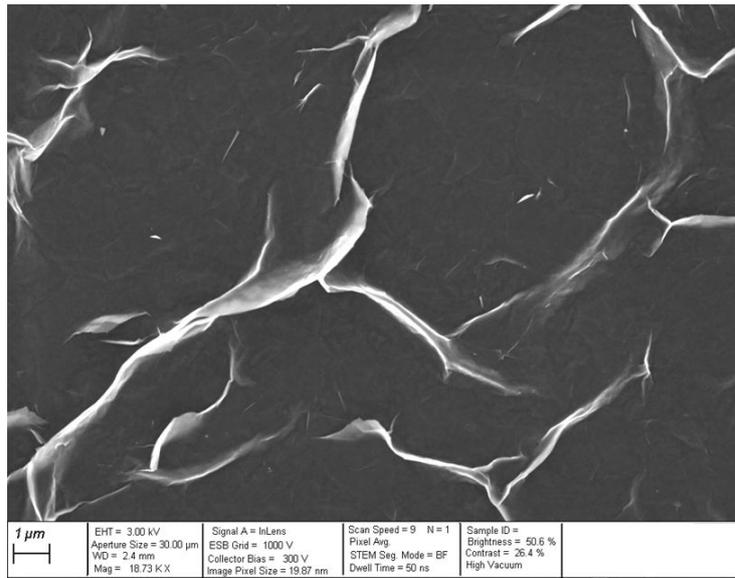
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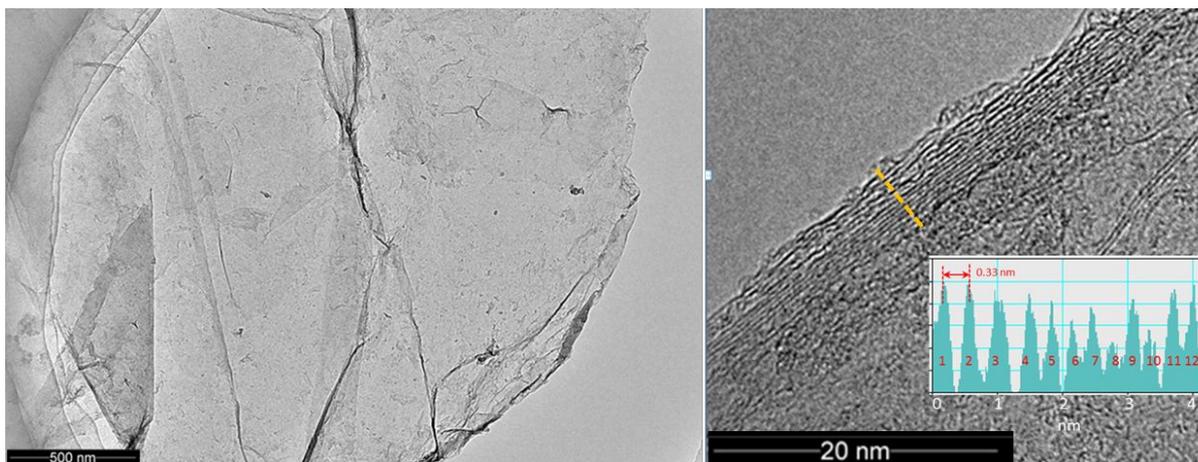
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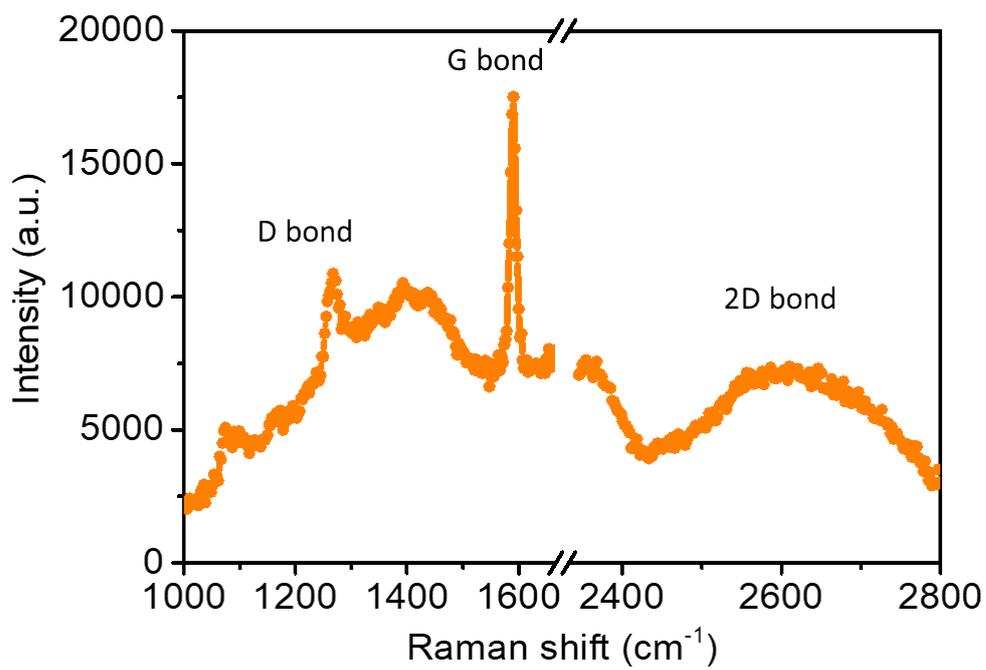


**Figure S1** SEM images of the synthesized EEG nanosheet.

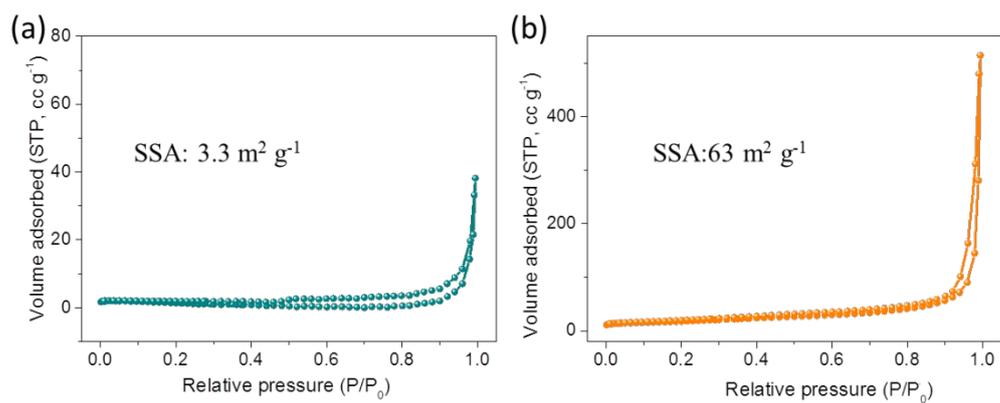


**Figure S2** TEM and HR-TEM images of the synthesized EEG nanosheets. The layer numbers of EEG along the orange dotted line are 12 layers.

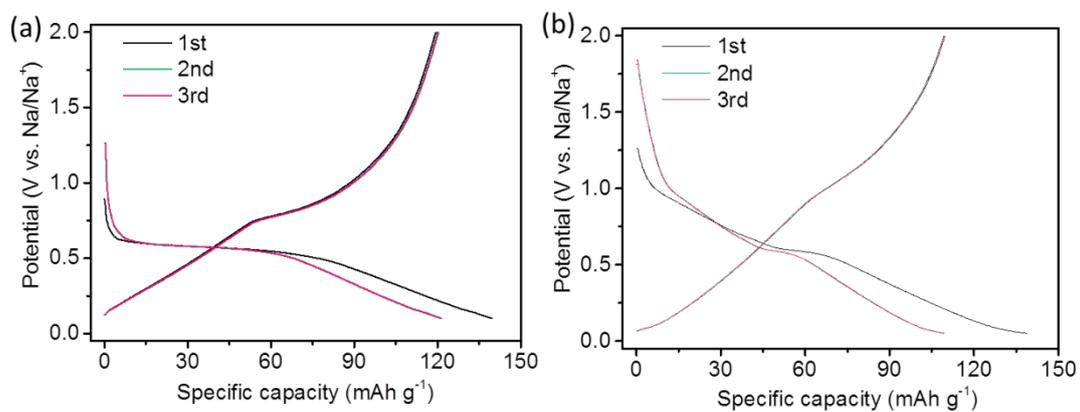
Notably, according to the definition of few-layer graphene, the layer numbers of few-layer graphene are in the range of 3–10 layers.<sup>1,2</sup> Here, for our sample, the layer numbers are above 10 layers. Thus, it is inappropriate to call our sample as graphene. As a result, we use the name of “electrochemically exfoliated graphite” instead of “electrochemically exfoliated graphene”.



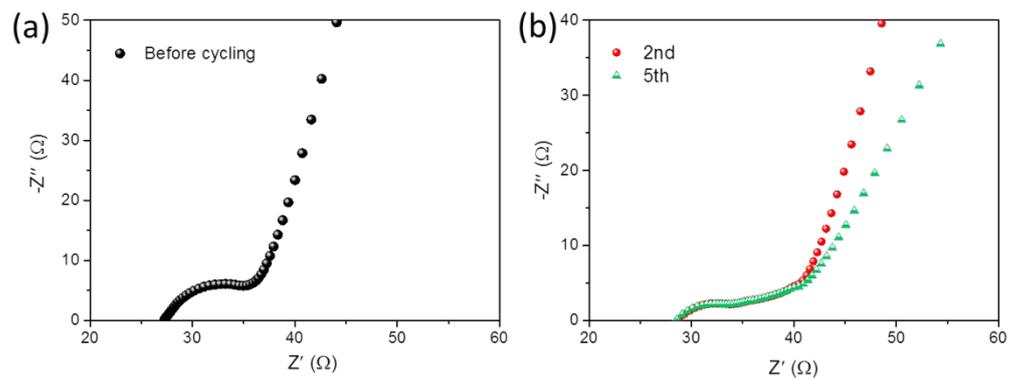
**Figure S3** Raman spectroscopy of the synthesized EEG nanosheets.



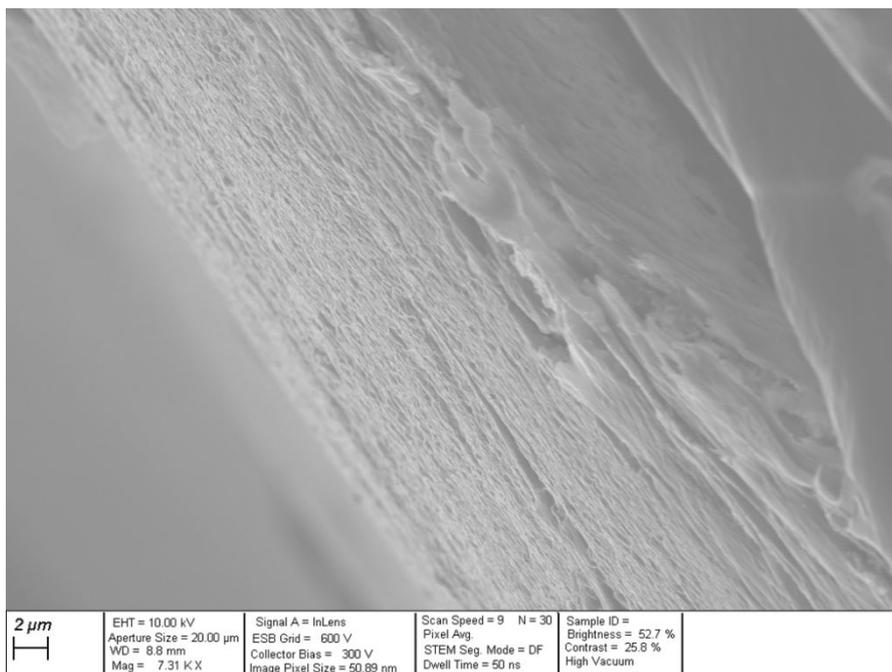
**Figure S4** N<sub>2</sub> adsorption-desorption isotherms of (a) graphite and (b) the synthesized EEG nanosheets.



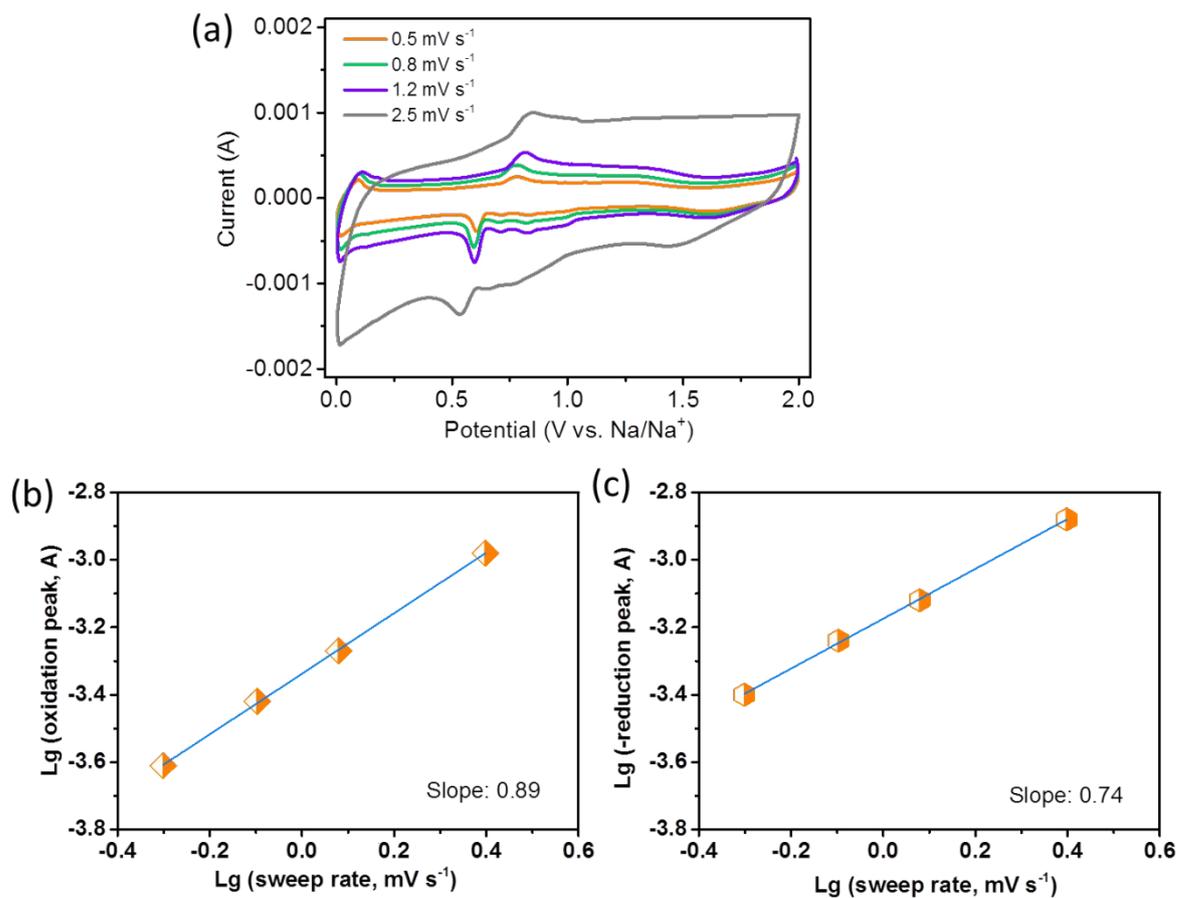
**Figure S5** The galvanostatic discharge/charge profiles of (a) pristine graphite and (b) EEG electrodes for the initial, the second, and the third cycles.



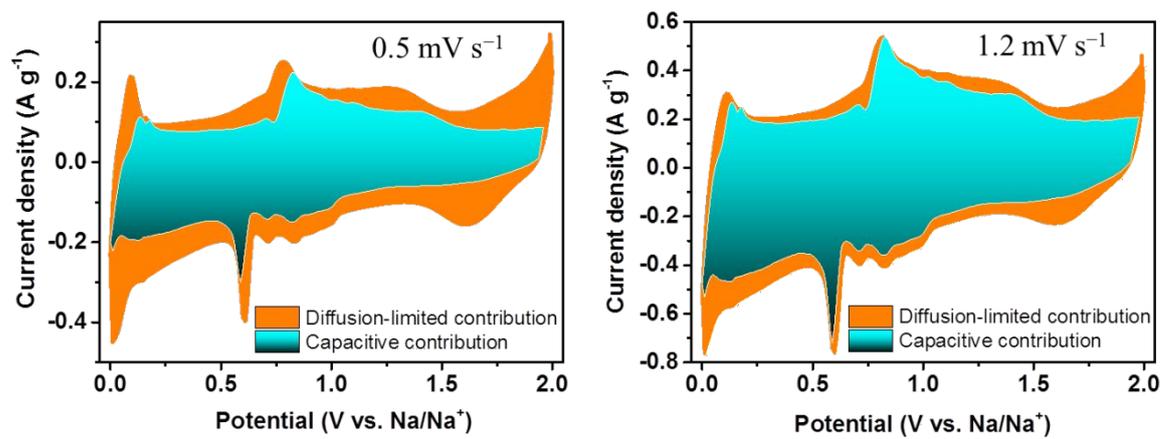
**Figure S6** Nyquist plots of the EEG electrode (a) before and (b) after cycles.



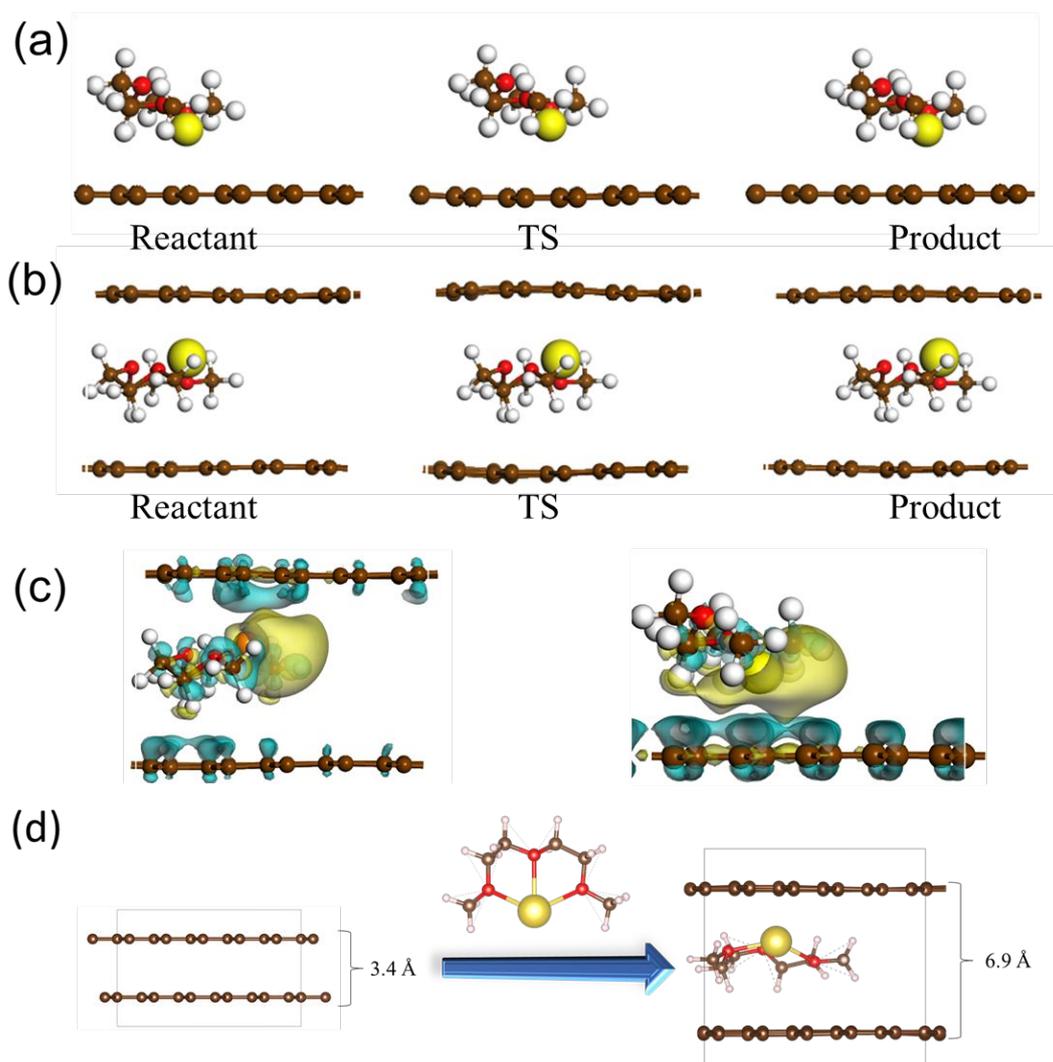
**Figure S7** SEM images of the cross-section of the EEG film for electrodes.



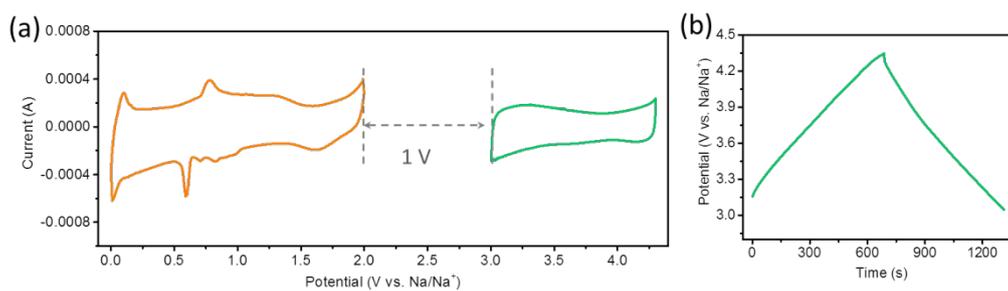
**Figure S8** (a) CV curves of EEG electrode at various sweep rates. The calculated b values for the (b) reduction and (c) oxidation peaks in the above CV curves.



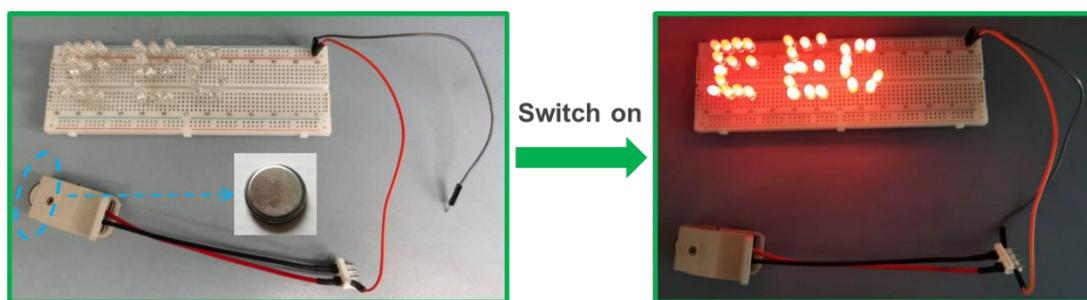
**Figure S9** Separation of the capacitive and diffusion currents at sweep rates of 0.5 and 1.2 mV s<sup>-1</sup>.



**Figure S10** DFT calculations for the structures of solvated Na-ion by the diethylene glycol dimethyl ether (DEGDME) molecules migration (a) on the surface and (b) in the interlayer. (c) The corresponding difference charge density plots. (d) The change of interlayer spacing after Na<sup>+</sup>-DEGDME complex co-intercalation in the interlayer.



**Figure S11** (a) The CV curve of AC cathode and EEG anode. (b) The galvanostatic discharge/charge profiles of AC cathode at  $0.3 \text{ A g}^{-1}$ . The mass ratio of AC cathode and EEG anode was identified according to the following equation:  $Q_+ = Q_- = m_+U_+C_+ = m_-U_-C_-$ ,<sup>3,4</sup> where  $Q$  is the capacity, and  $U$  is the potential range, and  $m$  is the mass of active electrode, and subscripts stand for the cathode and anode.



**Figure S12** The photographs of thirty-two red LEDs powered by the charged Na-ion capacitor based on EEG anode.

**References:**

1. Zhou, L.; Fox, L.; Włodek, M.; Islas, L.; Slastanova, A.; Robles, E.; Bikondoa, O.; Harniman, R.; Fox, N.; Cattelan, M.; Briscoe, W. H. Surface Structure of Few Layer Graphene. *Carbon*, 2018, 136, 255-261.
2. P. Bazylewski and G. Fanchini, Graphene: Properties and Applications. in *Comprehensive Nanoscience and Nanotechnology (Second Edition)*, 2019.
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4. Li, Y.; Yang, Y.; Zhou, P.; Chen, H.; Zhou, J.; Guo, S. Enhanced Cathode and Anode Compatibility for Boosting Both Energy and Power Densities of Na/K-Ion Hybrid Capacitors. *Matter*, 2019, 1, 893-910.