Electronic Supplementary Material (ESI) for Physical Chemistry Chemical Physics.

# Supporting Information

## Bioinspired hierarchical cross-linked graphene-silicon nanofilms via synergistic interfacial interactions as integrated negative electrodes for high-performance lithium storage

Bo Wang,*[a] Xiaoyu Wu,[b] Jinhui Zhang,[a] Xiaoyu Zhang,[a] and Songmei Li*[b]

[a] Department of Environmental and Chemical Engineering, Tangshan University, Tangshan 063000, P. R. China.

[b] Key Laboratory of Aerospace Advanced Materials and Performance of Ministry of Education, School of Materials Science and Engineering, Beihang University, Beijing, 100191, P. R. China

∗ Corresponding author. Tel: +86-315-2010649; Fax: +86-315-2010649.
E-mail address: wangbo@buaa.edu.cn.

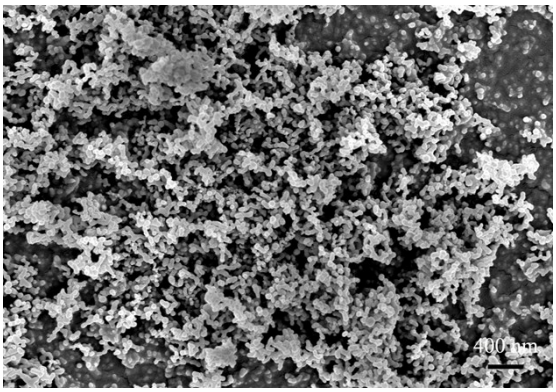


**Fig. S1** The SEM image of the Si nanoparticles powders.

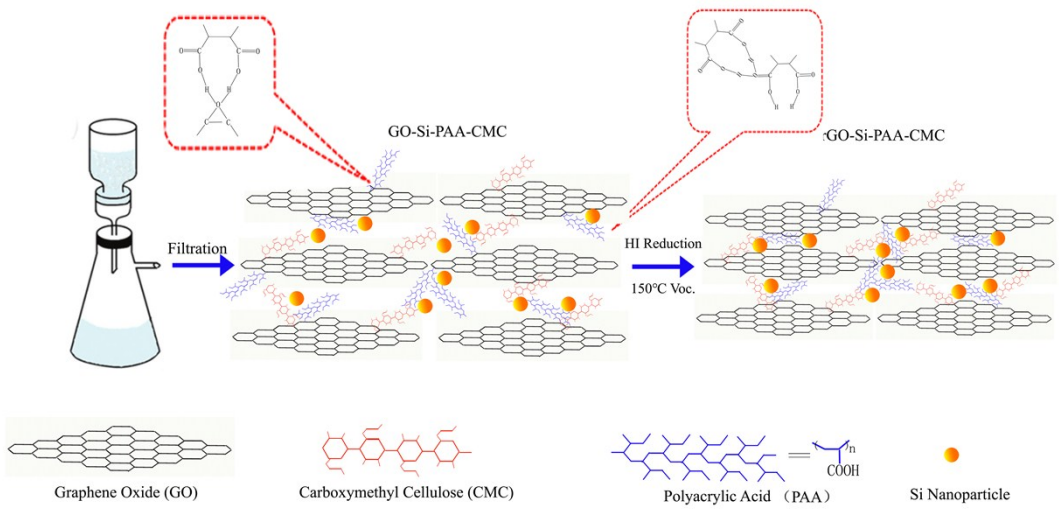


**Fig. S2** Schematic illustration of the synthesis process of rGO-Si-CMC-PAA films.

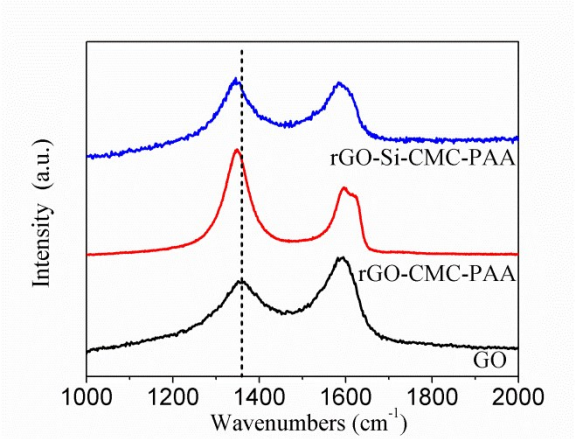


**Fig. S3** The enlargement of Raman spectra of as-prepared GO and rGO-Si-CMC-PAA films.

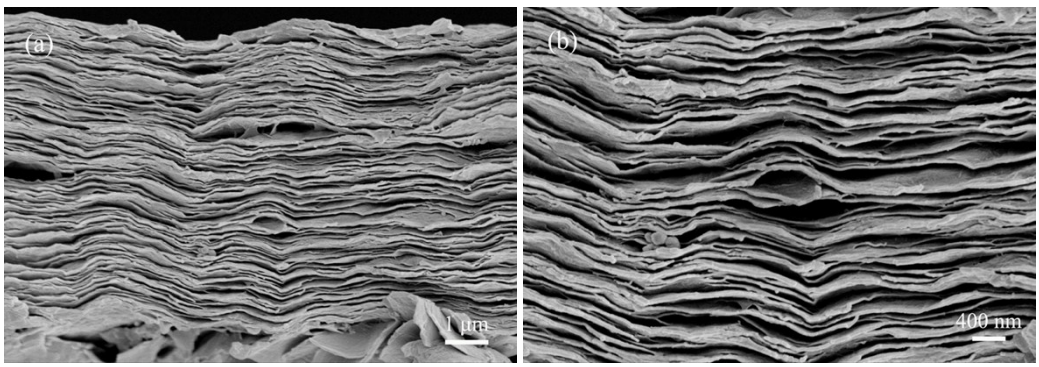


**Fig. S4** (a-b) SEM images of the as-prepared rGO-CMC-PAA nanocomposites at different magnifications.

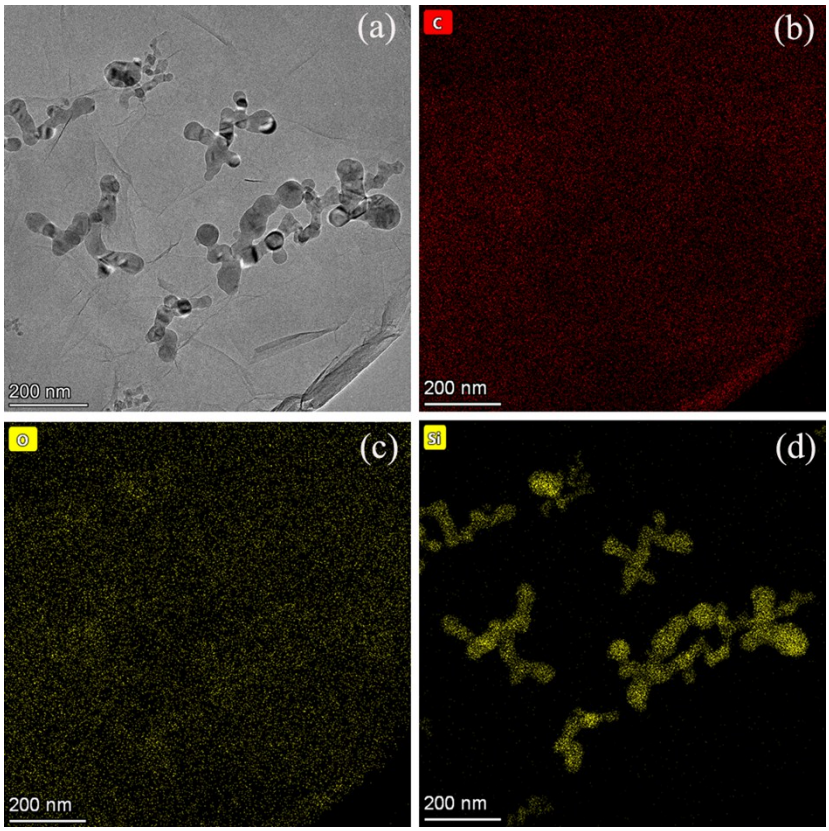


**Fig. S5** (a) TEM and (b-d) corresponding element mappings of rGO-Si-CMC-PAA films.

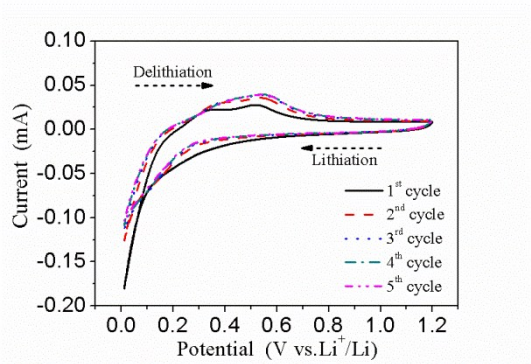


**Fig. S6** Cyclic voltammograms of Si NPs powder pasted electrode for the initial five cycles at a scan rate of 0.1 mV $s^{-1}$ in the voltage range of 0.01-1.2 V.

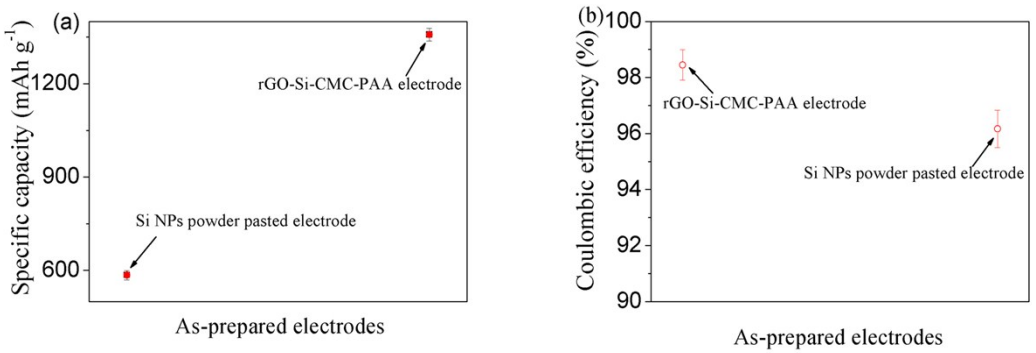


**Fig. S7** (a) The specific capacity and (b) Coulombic efficiency of conventional Si NPs powder pasted electrode and rGO-Si-CMC-PAA electrodes at the current density of 0.1C after 800 cycles; the scatter bands in the plots are standard deviations calculated from 10 parallel electrodes.

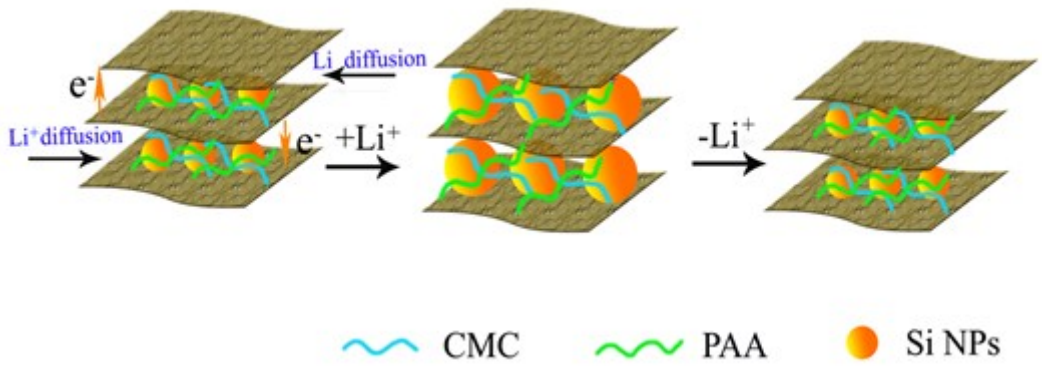


**Fig. S8** Possible working mechanism of rGO-Si-CMC-PAA electrode to accommodate the considerable volume change of Si particles during cycling.

**Table S1** The elemental composition of the rGO-Si-CMC-PAA films from the EDS （Fig. 3h）.

| *Elem* | *Weight %* | *Atomic %* |
|---|---|---|
| *C K* | 45.86 | 49.69 |
| *O K* | 11.05 | 14.19 |
| *Si K* | 43.09 | 36.12 |