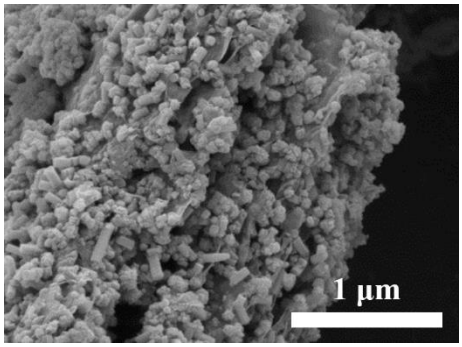
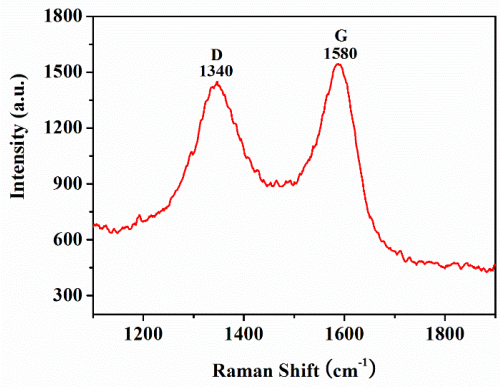
Supporting Information



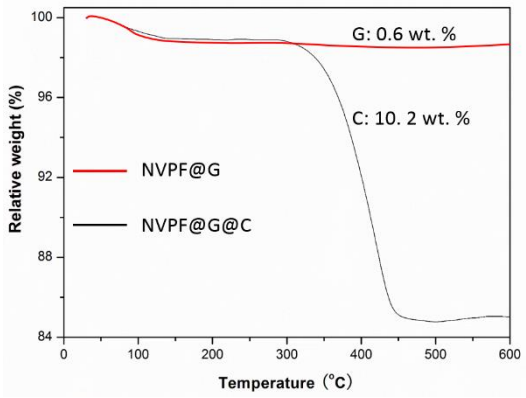
FigS1. The SEM images of NVPF/G.

The SEM image of NVPF/G was shown in FigS1. It reveals that the NVPF@G possess a layered structure, as shown from various perspectives. Multiple layers of NVPF cubes stack between the parallel graphene sheets.



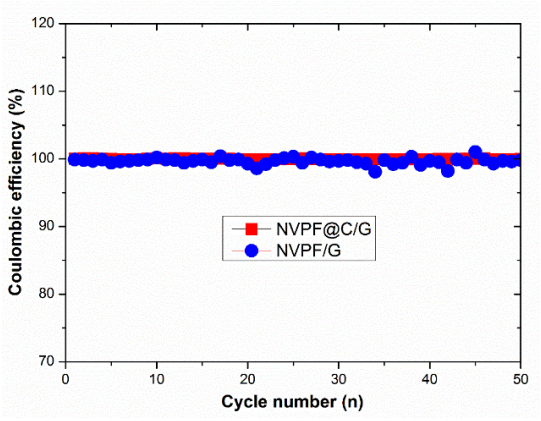
FigS2. Raman curves of the NVPF@C/G

To certify their existing of graphene and carbon, Raman was used to test NVPF@C/G sample, and the curves are shown in Fig S2. From Raman spectra in FigS2, the D and G bands appeared at 1340 cm^{-1} and 1580 cm^{-1}, which can be assigned to typical D and G bands of the carbon materials respectively. The D band originated from defects associated with vacancies and amorphous carbon species and the G band corresponded to ordered sp2 bonded carbon atoms[48]. And the Raman intensity of the D band is close to the G band, which indicates the high quality of the graphene and carbon compose.



FigS3. TG curves of the NVPF@G and NVPF@C/G.

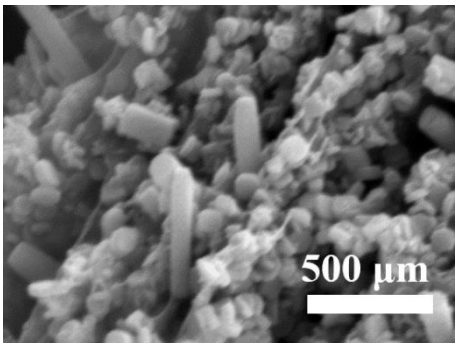
To further confirm the carbon content in NVPF@C/G, the TG of NVPF@G and NVPF@C/G was characterized in Fig S3. We can obtain that the total weight loss is 2.6% and 12% for the two samples, respectively, in which 2% and 1.8% water weight loss was included. Thus, the carbon weight is 0.6% and 10.2% for NVPF@G and NVPF@C/G, respectively.



FigS4.Coulombic efficiency of NVPF@C/G and NVPF/G at 2 C in 2.0-4.3V for 50 cycles, (the black on behalf of NVPF@C/G, the red on behalf of NVPF/G)

In FigS4, we can see the coulombic efficiency of NVPF@C/G is always close to 100% during the cycling tests, whereas the coulombic efficiency for NVPF/G has a little fluctuation. It indicates that NVPF@C/G has better reversibility, thanks to unique carbon coating which makes

the NVPF more stable during the Na^+ intercalation and deintercalation process.



FigS5. The SEM images of NVPF/G after charge-discharge process for 200 cycles at 2C

Moreover, the microstructures of the cycled cathode materials were investigated by SEM, as shown in Fig S5. It can be see that the morphology and structure of NVPF@C/G change little after 50 cycles at 2 C current, demonstrating that carbon nano-coating could effectively improve the structural stability in this structure after long cycles, which is accorded with the high capacity retention, 96.8% after 50 cycles.