**Supplementary Information**

**Robust Three-Dimensional Graphene Skeleton Encapsulated**

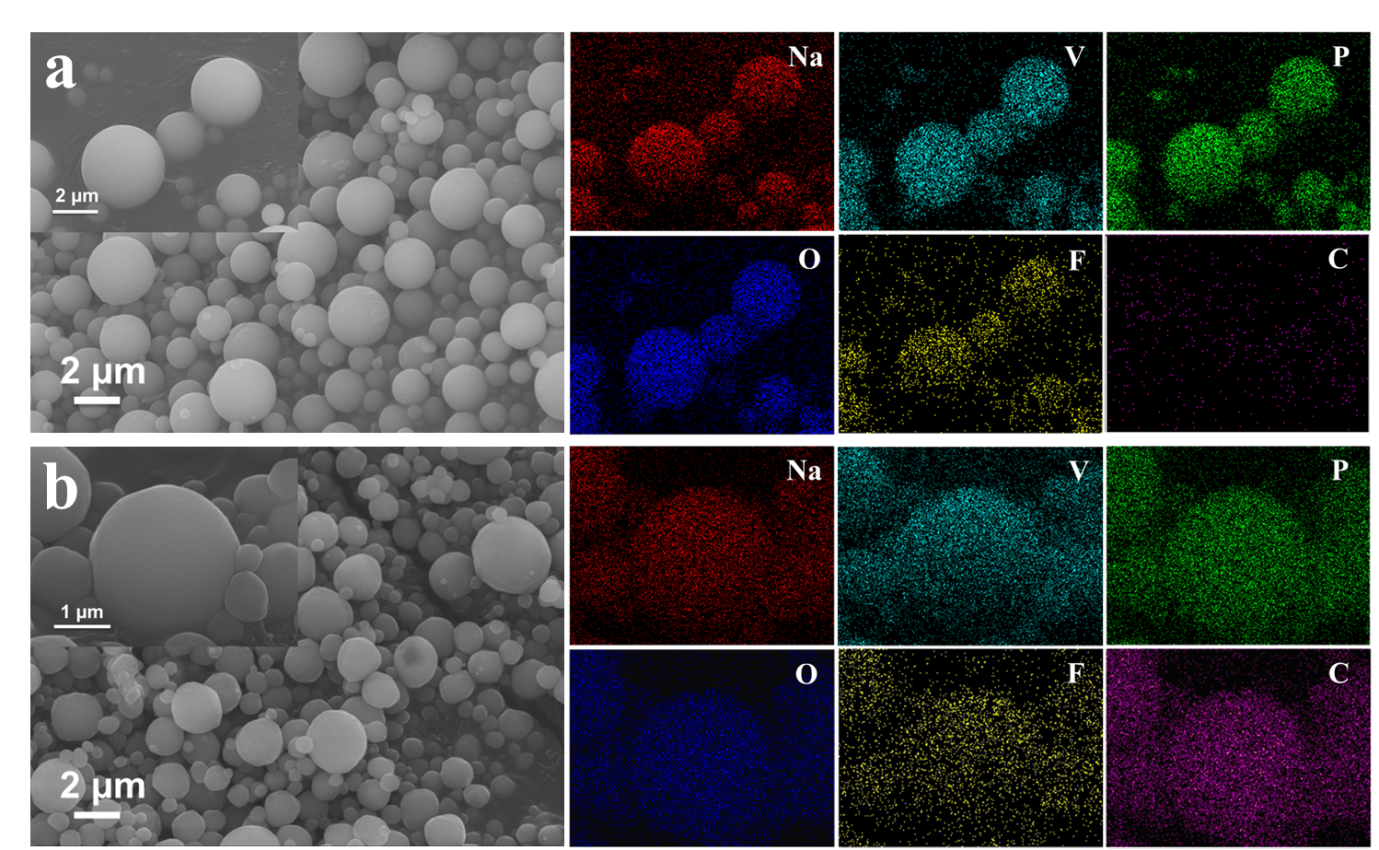
**Na3V2O2(PO4)2F Nanoparticles as a High-Rate and Long-Life Cathode of Sodium-Ion Batteries**

Yameng Yina, Fangyu Xionga, Cunyuan Peia, Yanan Xua, Qinyou An\*a, Shuangshuang Tana Zechao Zhuanga, Jinzhi Shenga, Qidong Lia, and Liqiang Mai\*a,b

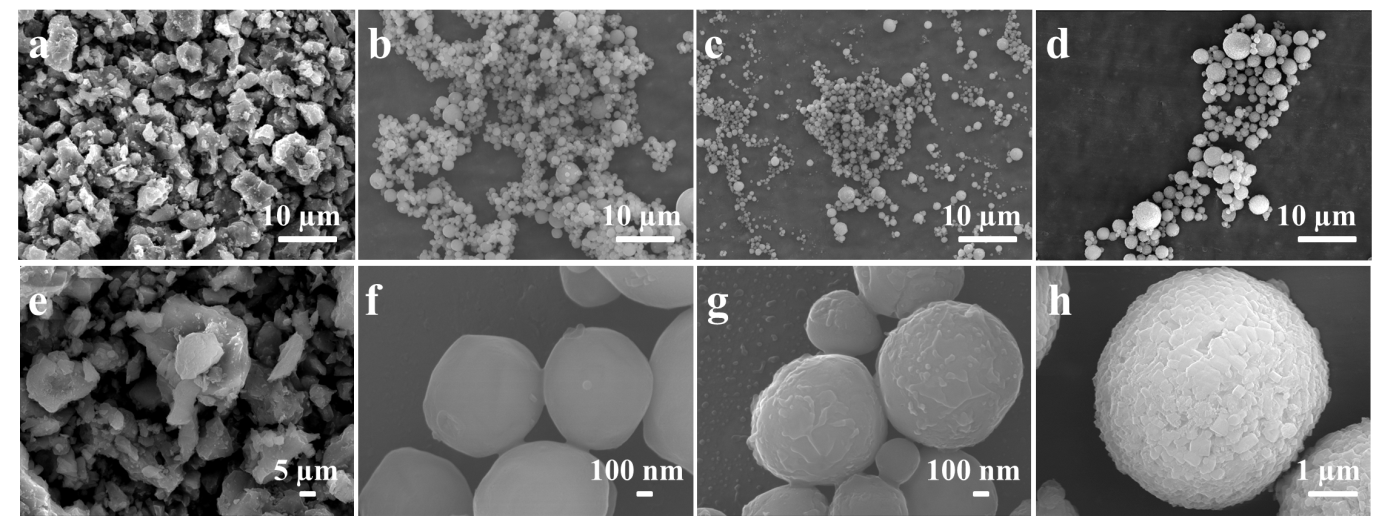
*a* State Key Laboratory of Advanced Technology for Materials Synthesis and Processing, International School of Materials Science and Engineering, Wuhan University of Technology, Wuhan, 430070, P. R. China.

*b* Department of Chemistry, University of California, Berkeley, California 94720, United States

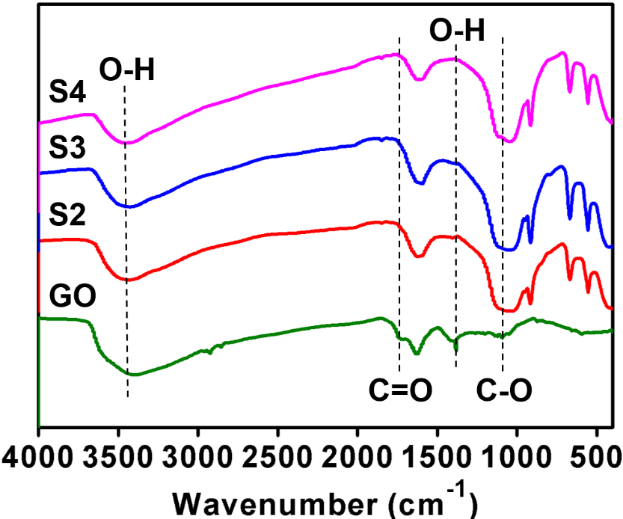
\*Corresponding Authors: E-mail: [anqinyou86@whut.edu.cn](mailto:anqinyou86@whut.edu.cn) ; [mlq518@whut.edu.cn](mailto:mlq518@whut.edu.cn)



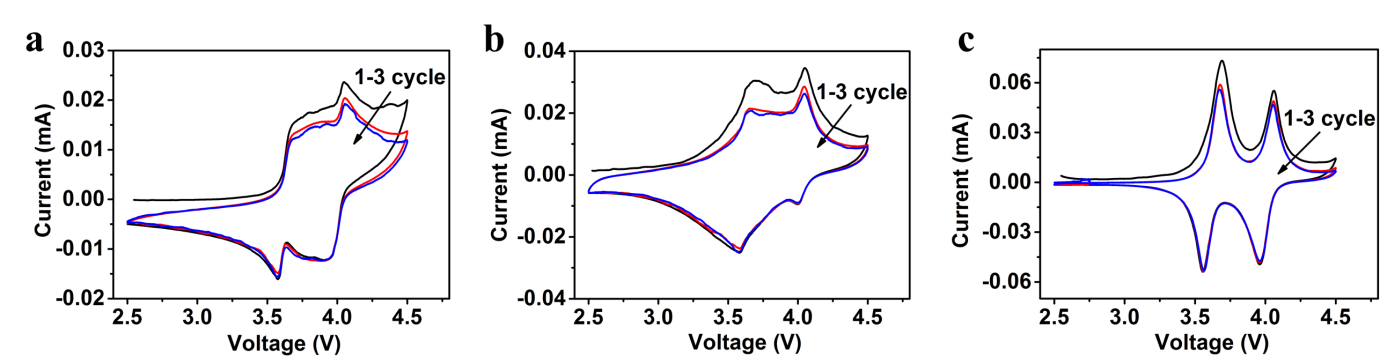
**Fig. S1** The FESEM images and elemental mapping images of NVOPF (a) and NVOPF/rGO (b) before calcination.



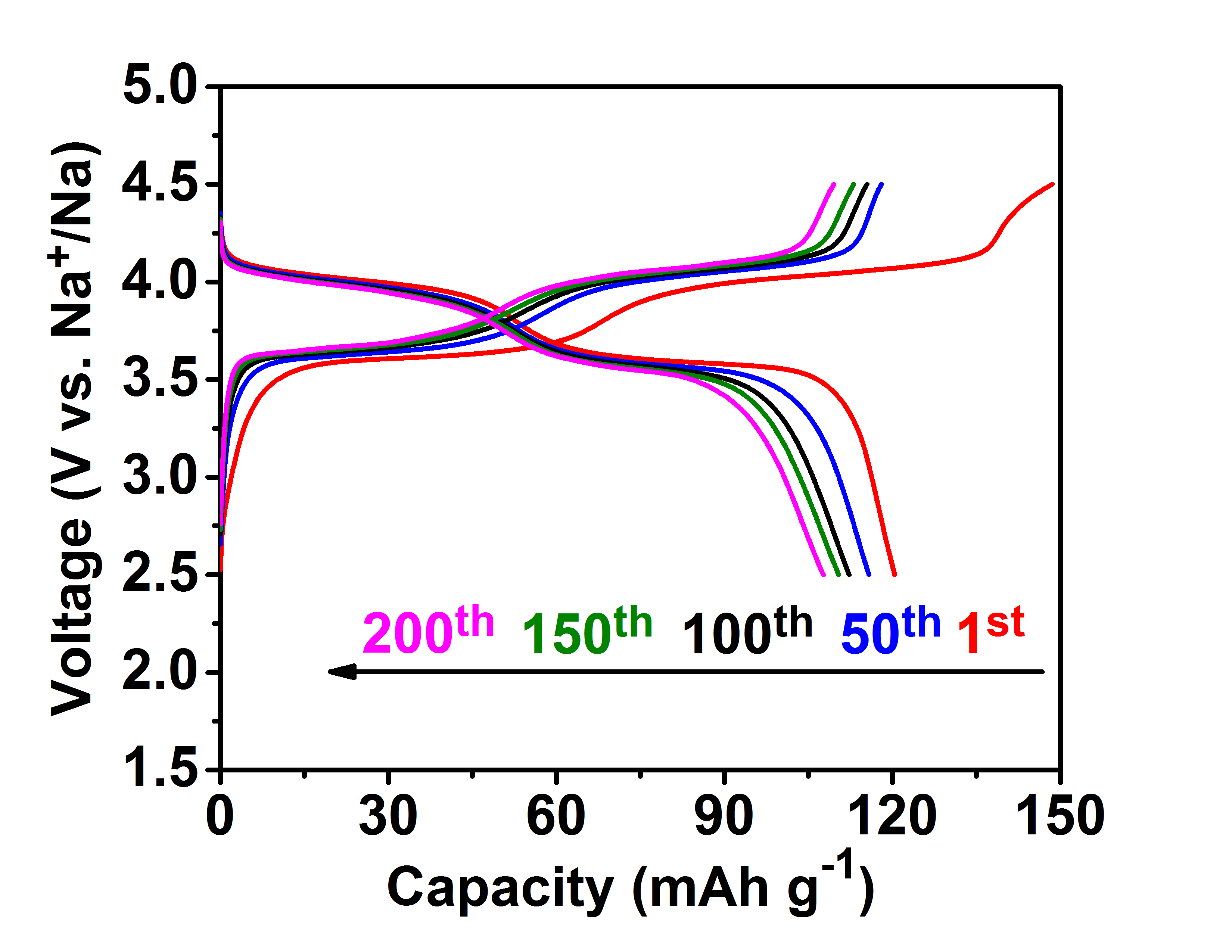
**Fig. S2** The FESEM images of S1 (a, e), S2 (b, f), S3 (c, g) and S4 (d, h).



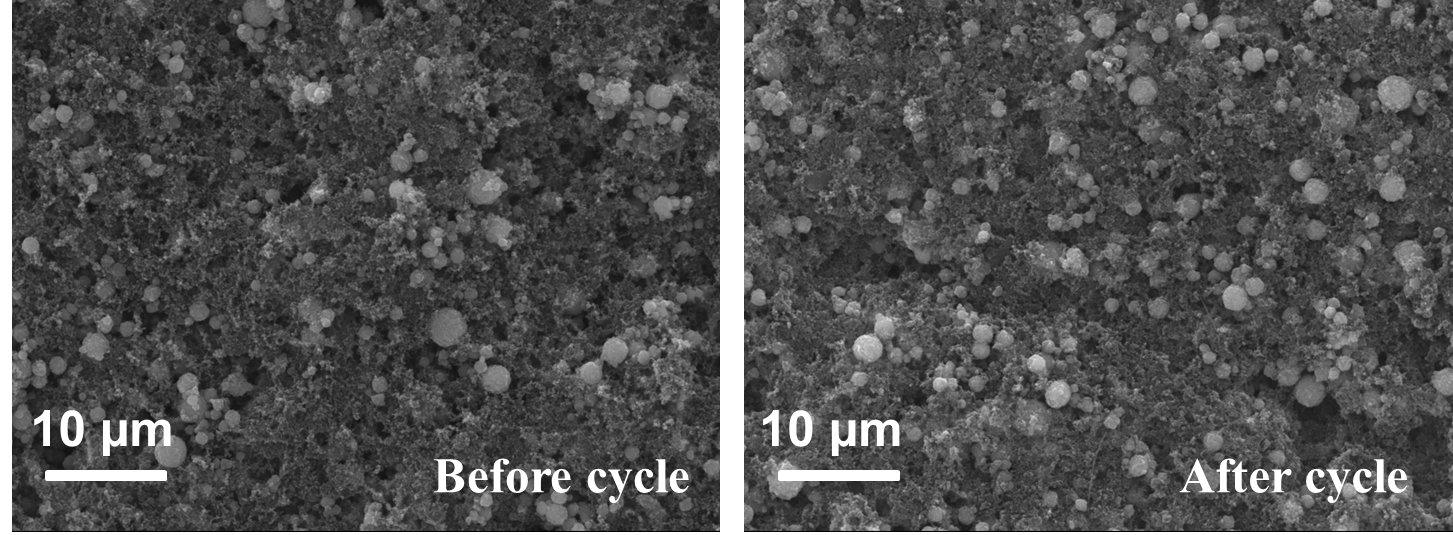
**Fig. S3** FTIR spectra of graphite oxide and three annealing samples (S2-S4).



**Fig. S4** The CV curves of S1 (a), S2 (b) and S3 (c) in first three cycles at a scan rate of 0.1 mV s−1 in the potential range from 2.5 to 4.5 V.



**Fig. S5** The charge/discharge curves of S4 in different cycles at 0.5 C.



**Fig. S6** The FESEM images of S4 before and after 2000 cycles at 30 C.

**Table S1.** The performancecomparison of the Na3V2O2(PO4)2F electrodes in the references.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **NVOPF samples** | **Carbon content** | **Preparation method** | **Voltage window** | **Rate capacity** |
| NVOPF/RGO14 | 5.8 wt% | solvothermal | 2.5-4.5 V | 29 mA h g−1 at 20 C |
| NVOPF-MWCNT15 | / | hydrothermal | 2.5-4.5 V | 59 mA h g−1 at 20 C |
| NVOPF@C/GO16 | 8.1 wt% | hydrothermal | 2.0-4.3 V | 78.5 mA h g−1 at 10 C |
| RuO2-coated NVOPF17 | / | Micro-emulsion-  mediated hydrothermal | 2.5-4.3 V | 71 mA h g−1 at 40 C |
| RuO2-coated Ru-doping NVOPF18 | / | solvothermal | 2.5-4.5 V | 82 mA h g−1 at 50 C  44.9 mA h g−1 at 100 C |
| **This work** | **1.9 wt%** | **Spray**-**drying** | **2.5**-**4.5 V** | **83.6 mA h g−1 at 50 C**  **70.3 mA h g−1 at 100C** |