

**Supporting Information for**

**Trace Amounts of Water-Induced Distinct Growth Behaviors of NiO Nanostructures on Graphene in CO<sub>2</sub>-Expanded Ethanol and Their Applications in Lithium-Ion Batteries**

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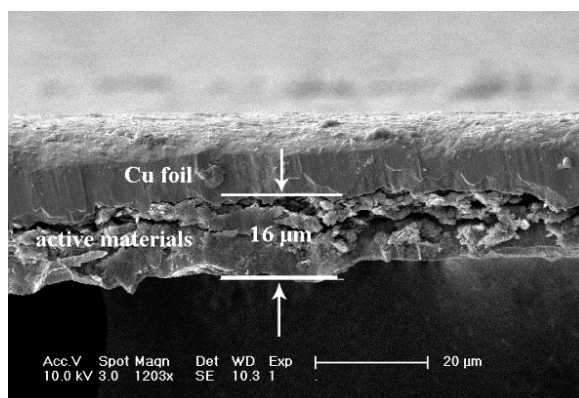


Figure S1 SEM image of the cross section of an electrode.

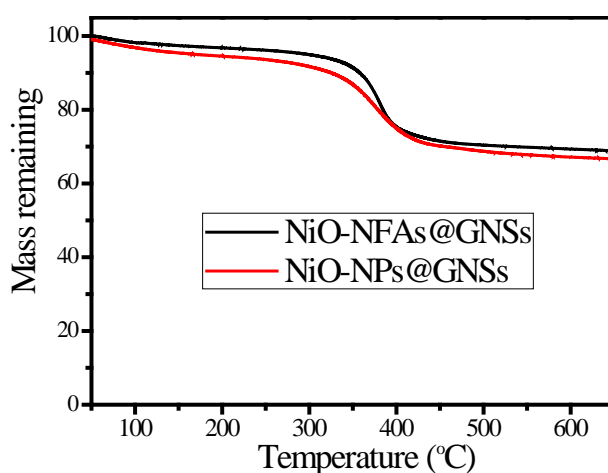


Figure S2. TGA analysis for the NiO-NPs@GNSs and NiO-NFAs@GNSs.

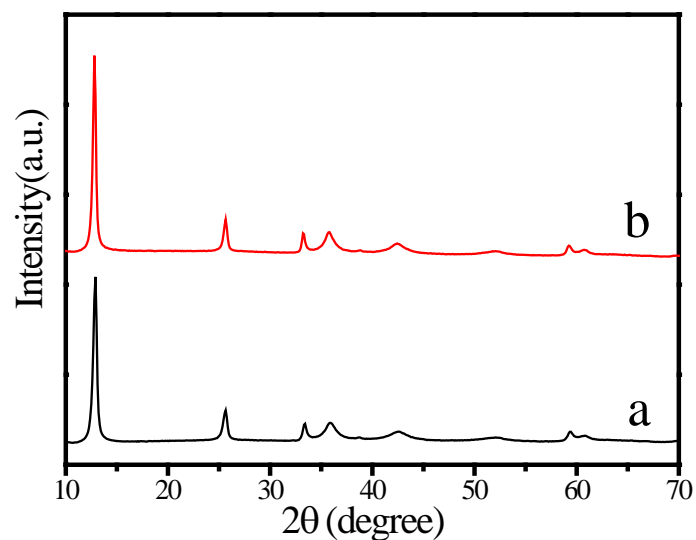


Figure S3. XRD patterns of the intermediate compounds formed in (a) pure ethanol, (b) ethanol with additional water (40 $\mu$ L).

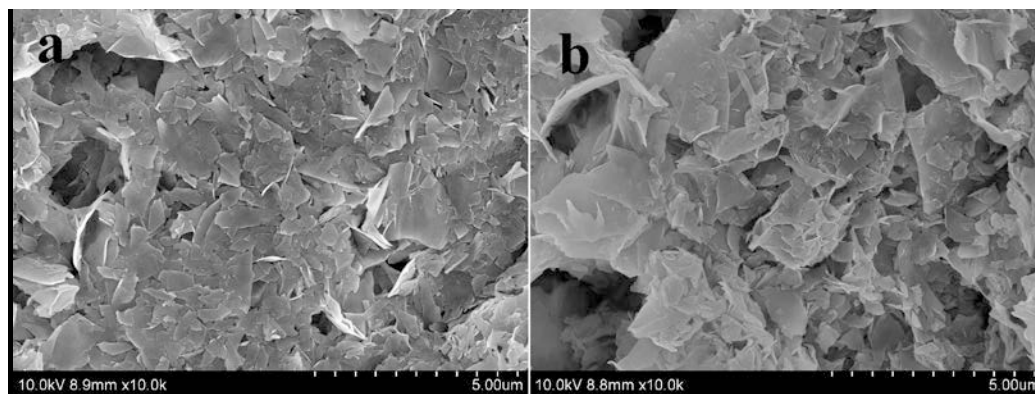


Figure S4. SEM images of the intermediate compounds formed in (a) pure ethanol, (b) ethanol with additional water (40 $\mu$ L).

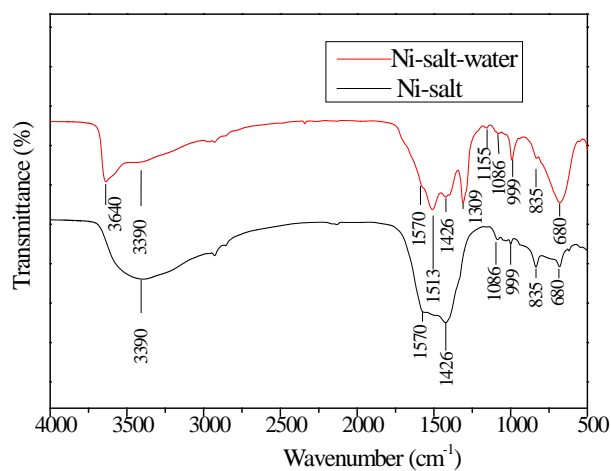


Figure S5. FTIR spectra of the precursors formed in CO<sub>2</sub>-expanded ethanol.

The bands at 1570, 1513, 1309, 1086 cm<sup>-1</sup> suggest the presence of the carbonate or bicarbonate

species that may result from the reaction of CO<sub>2</sub> and H<sub>2</sub>O. The bands at 1426, 1155, 1086, 999 cm<sup>-1</sup> were assigned to the anti-symmetric stretching vibration of  $\nu_4$  (-ONO<sub>2</sub>) (1485–1415 cm<sup>-1</sup>), the symmetric stretching vibration of  $\nu_1$  (-ONO<sub>2</sub>) (1340–1305 cm<sup>-1</sup>), the totally symmetric in-plane stretching vibration of  $\nu_2$  (-ONO<sub>2</sub>) (1087–1037 cm<sup>-1</sup>). The absorption bands including 825–895 cm<sup>-1</sup> and 645–684 cm<sup>-1</sup> were assigned, respectively, to the overlapped absorption band of the out-of-plane bending vibration of  $\nu_6$  (-ONO<sub>2</sub>) and  $\nu_8$  (-OCO<sub>2</sub>), the symmetric in-plane bending vibration of  $\nu_3$  (-ONO<sub>2</sub>) and  $\nu_6$  (-OCO<sub>2</sub>). Furthermore, the broad adsorption band at 3640–3400 cm<sup>-1</sup> may be assigned to the stretching vibration of OH, and that lower than 3400 cm<sup>-1</sup> may be assigned to  $\nu$  (H<sub>2</sub>O).<sup>1,2</sup>

Table S1 The C, H, N content (wt. %) in the precursors.

Samples		Weight (mg)	N (%)	C (%)	H (%)
Ni-salt	1	2.2540	1.71	10.69	2.771
	2	2.3640	1.76	10.71	2.746
Ni-salt-water	3	2.2740	3.30	6.50	2.135
	4	2.3120	3.31	6.53	2.140

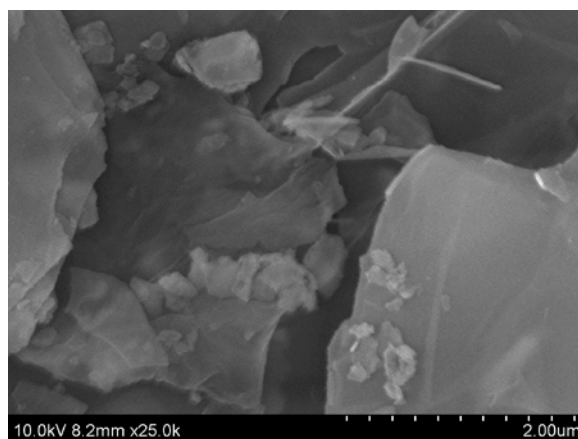


Figure S6. SEM image of the NiO@GNSs composite formed in pure ethanol.

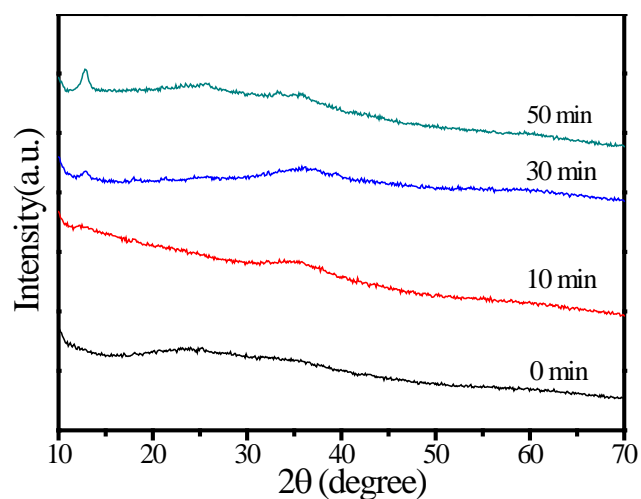


Figure S7 XRD patterns of the samples collected at different times after the temperature reached 200 °C during the formation of 3D flowerlike microstructure.

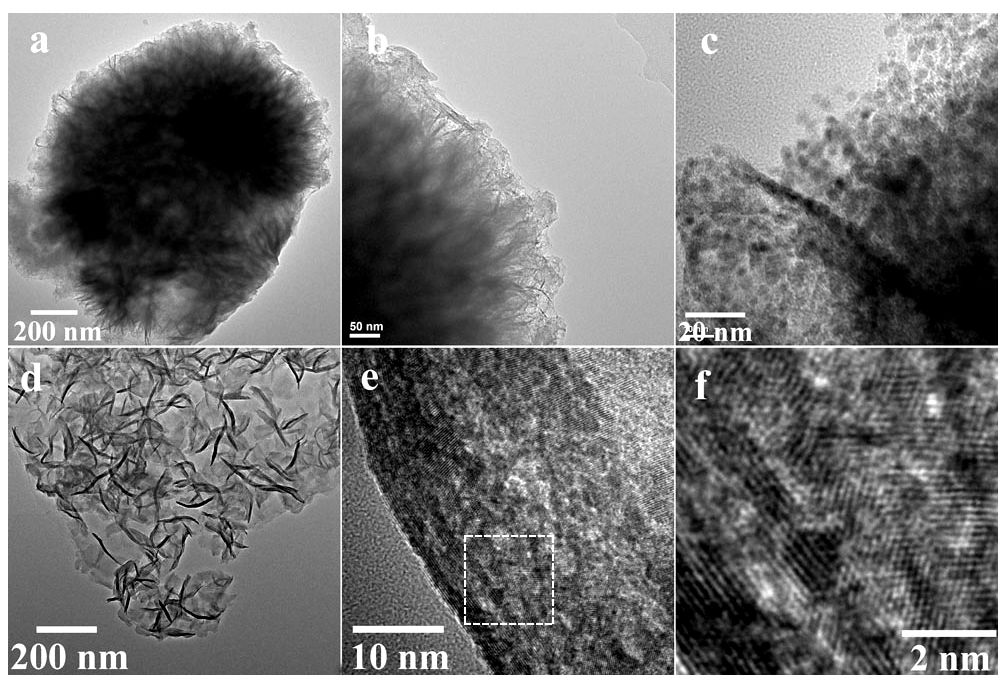


Figure S8 (a, b, c) TEM images of 3D flowerlike microstructure with different magnification. (d, e) TEM images of Ni-salt NFAs@GO with different magnification. (f) HRTEM image of the area marked within white rectangle in Figure S8e.

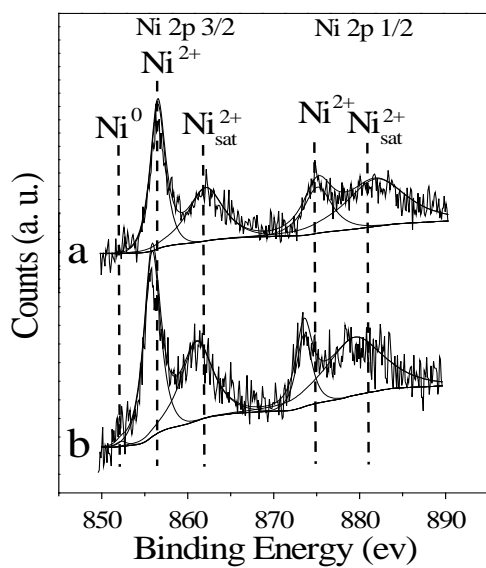


Figure S9. Ni 2p XPS spectra for the samples after 100 cycle (a) NiO-NPs@GNSs and (b) NiO-NFAs@GNSs.

1. J. C. Hu, K. K. Zhu, L. F. Chen, H. J. Yang, Z. Li, A. Suchopar and R. Richards, *Adv. Mater.*, 2008, **20**, 267.
2. J. Ming, C. Y. Wu, H. Y. Cheng, Y. C. Yu and F. Y. Zhao, *J. Supercrit. Fluids*, 2011, **57**, 137.