Electronic Supplementary Material (ESI) for CrystEngComm.

Supporting Information

Morphology-controlled growth of $Co_{11}(HPO_3)_8(OH)_6$ on nickel foam for quasi-solid-state supercapacitor applications

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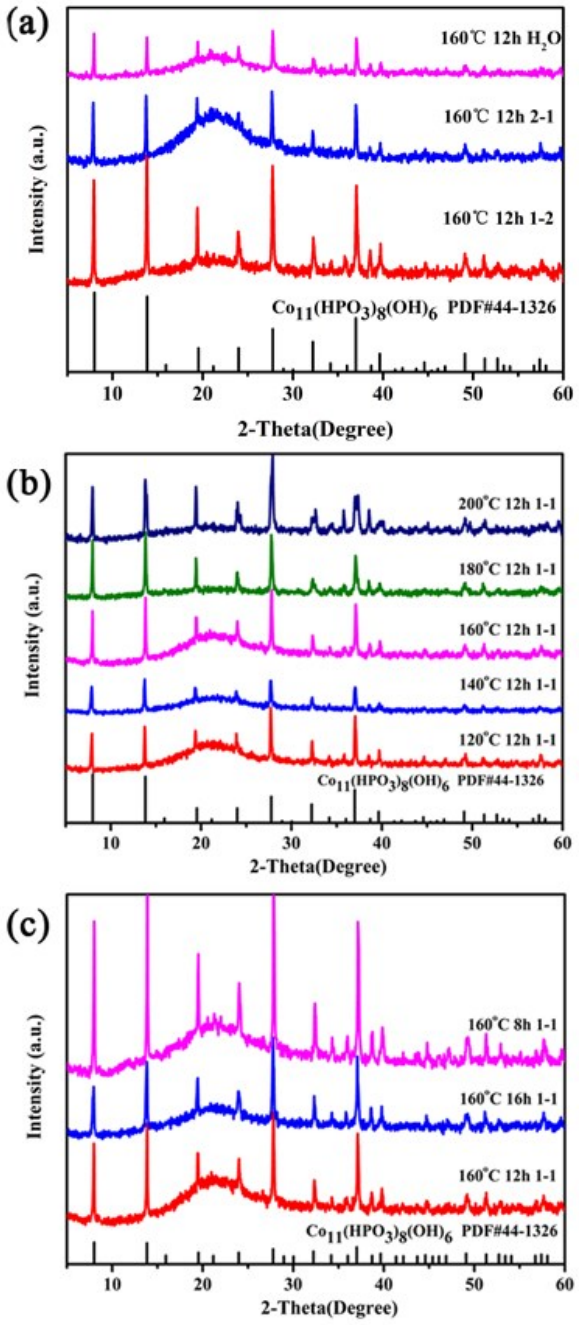

Figure S1 XRD patterns at different (a) solvents; (b) temperatures; (c) times.

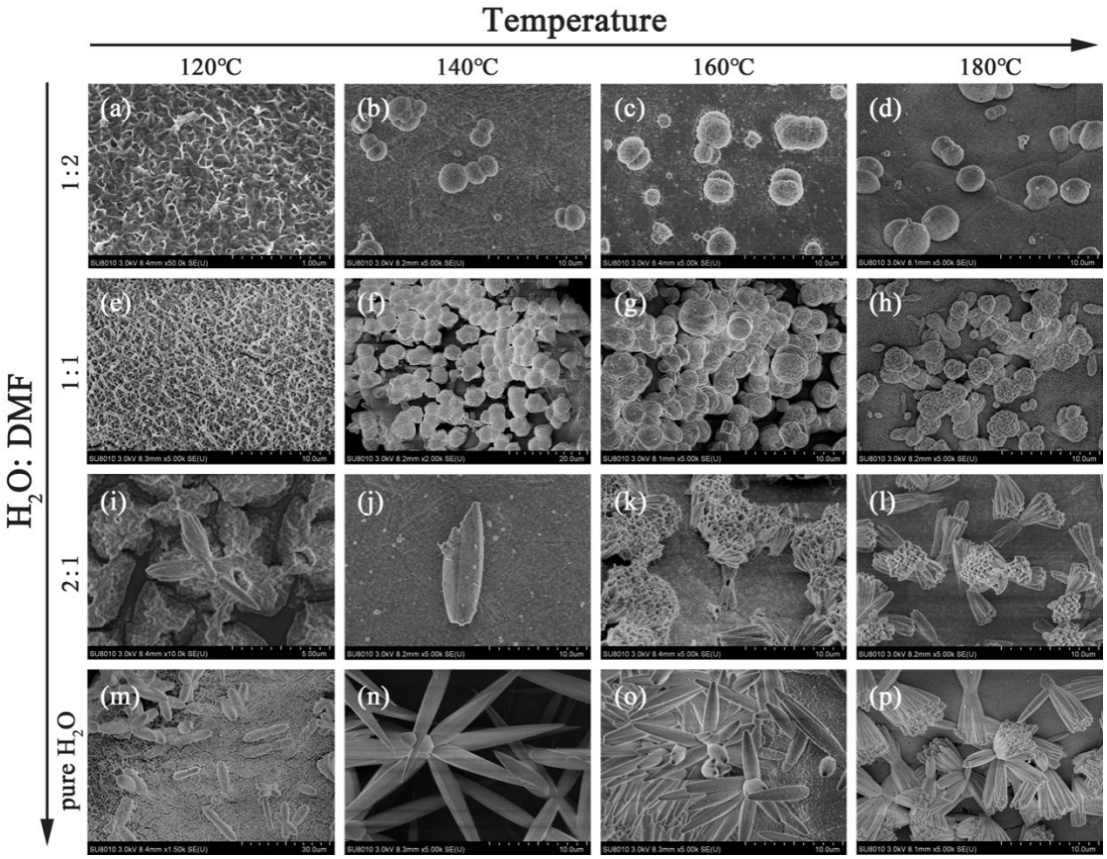

Figure S2 The SEM of $Co_{11}(HPO_3)_8(OH)_6$ at different solvents ratios and temperatures.

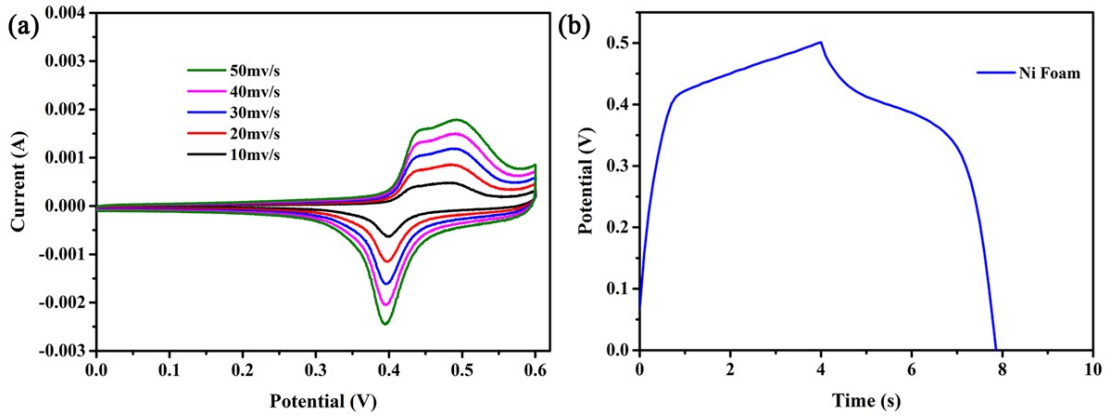

Figure S3 The CV curves at 10-50 mV and GCD curves at 1 A/g of Ni foam.

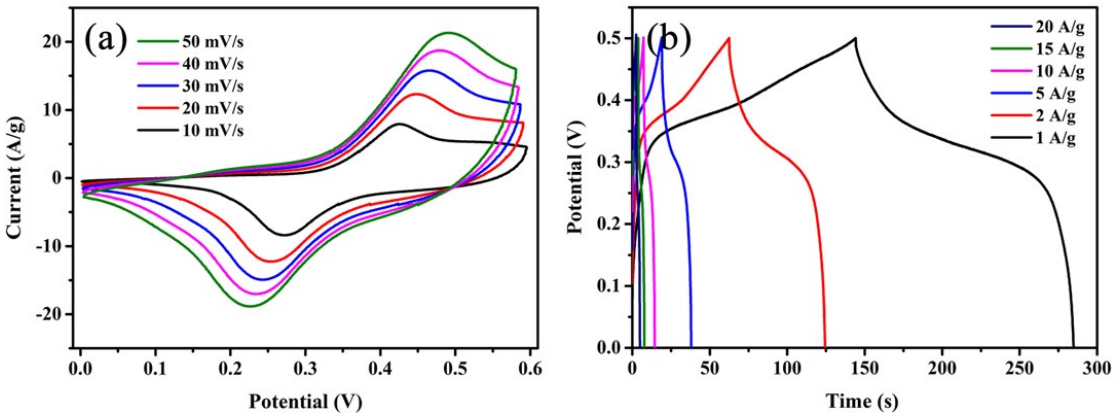

Figure S4 The CV curves at at different scan rates and GCD curves at various current densities of 160 ℃ 12 h H_2O.

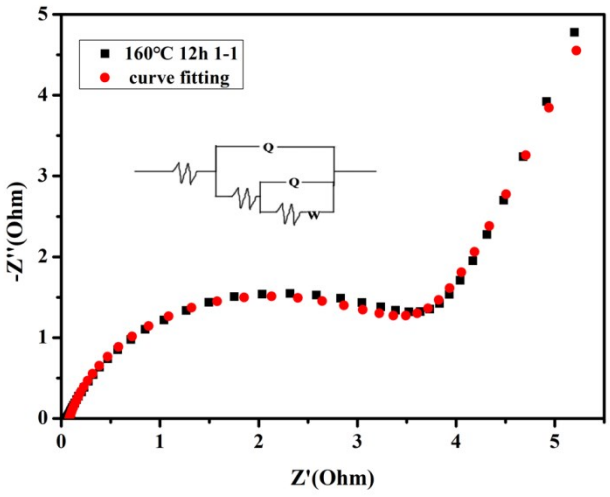

Figure S5 The Nyquist plots and equivalent circuits of $Co_{11}(HPO_3)_8(OH)_6$.

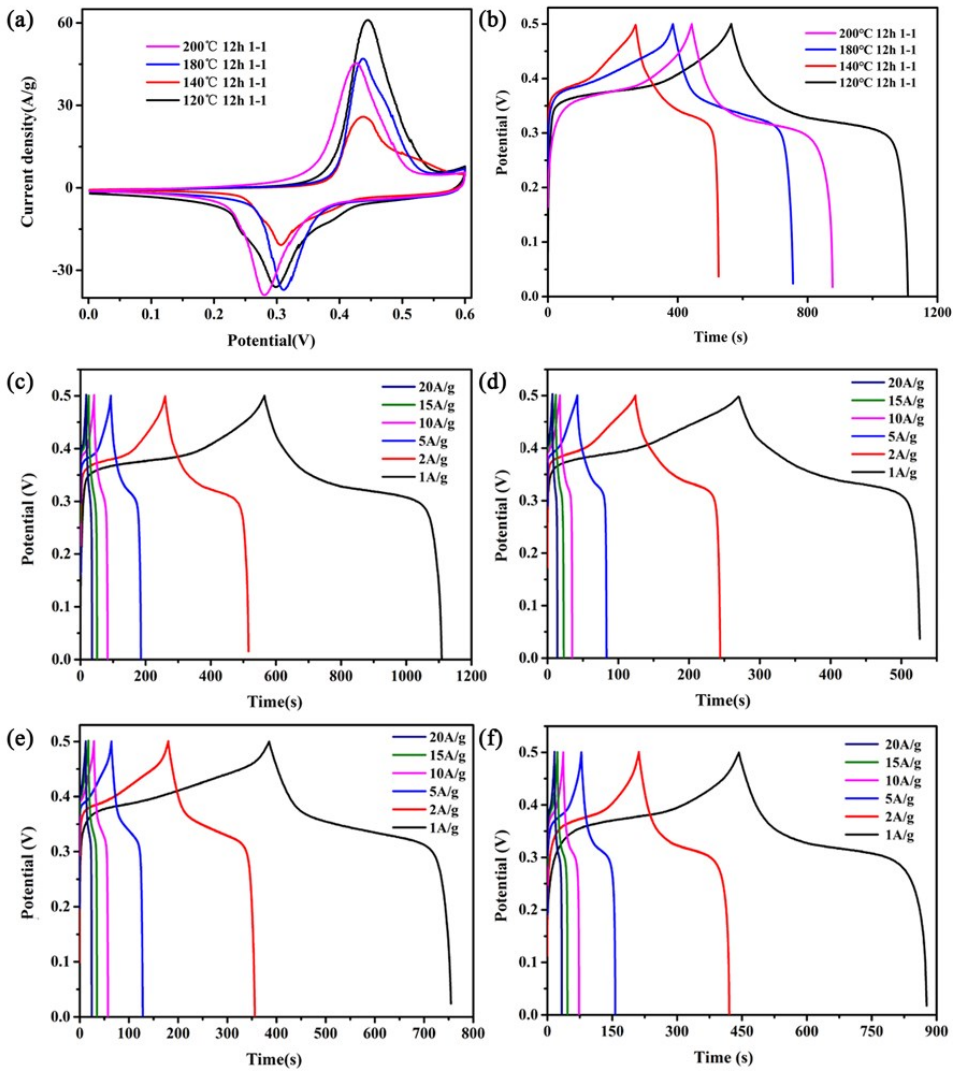

Figure S6 (a) The CV curves at different temperatures; (b) The GCD curves at different temperatures; The GCD curves at various current densities of (c) 120 ℃ 12 h 1-1; (d) 140 ℃ 12 h 1-1; (e) 180 ℃ 12 h 1-1; (f) 200 ℃ 12 h 1-1.

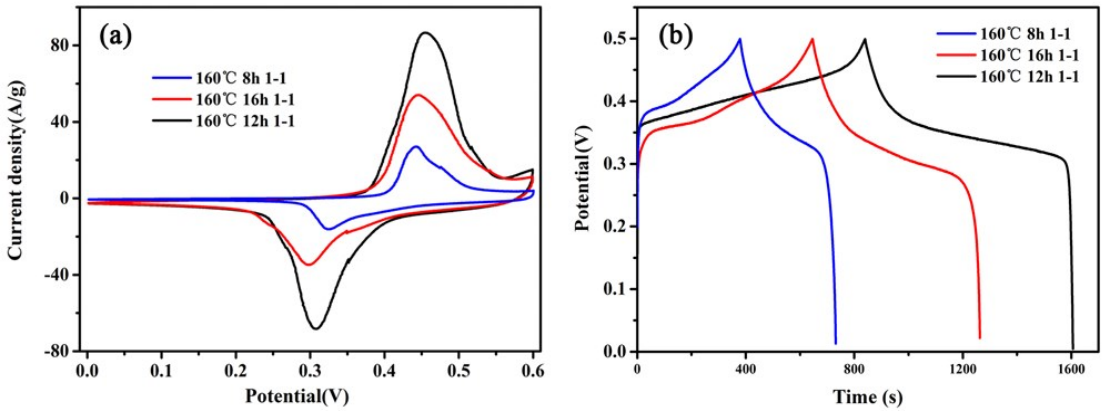

Figure S7 (a) The CV curves; (b) The GCD curves at different times.

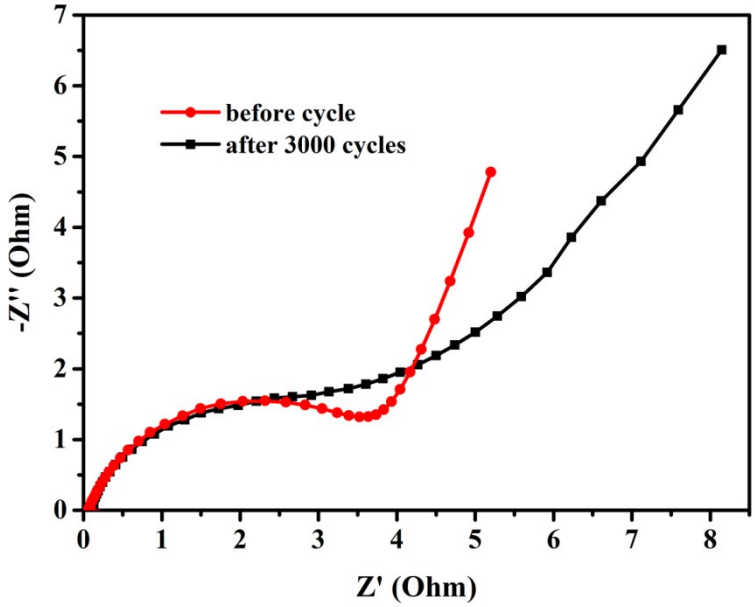

Figure S8 The Nyquist plots of $Co_{11}(HPO_3)_8(OH)_6$ before and after 3000 cycles.

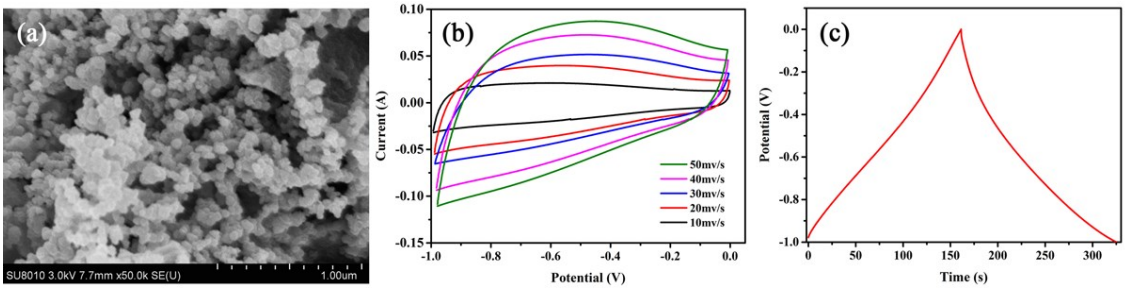

Figure S9 The microstructure and electrochemical performance of AC. (a) SEM; (b) The CV curves at different scan rates; (c) The GCD curves at the current density of 1 A/g.

Table S1 The comparison of electrochemical performance of metal phosphides electrode materials.

Electrode	Specific capacitance (at 1 A/g)	Electrolyte	Rate performance	Ref.
$Co_{11}(HPO_3)_8(OH)_6$	**919.3 C/g (1532.2 F/g）**	**2 M KOH**	**71.3 % (20 A/g)**	**This work**
$Co_{11}(HPO_3)_8(OH)_6$	226 F/g	3 M KOH	76 % (7 A/g)	[1]
$Co_{11}(HPO_3)_8$ $(OH)_6$-Co_3O_4	1200 F/g (0.5 A/g)	3 M KOH	89 % (6 A/g)	[2]
Ni-$Co_3(PO_4)_2$	1132.5 F/g	3 M KOH	63.3 % (10 A/g)	[3]
$Co_2Mn(PO_4)_2$	525 F/g	3 M KOH	58 % (8 A/g)	[4]
$Co_3(PO_4)_2$	188 F/g (3 A/g)	3 M KOH	68 % (9 A/g)	[5]
$Co_3(PO_4)_2 \cdot 8H_2O$	350 F/g	3 M KOH	64.8 % (10 A/g)	[6]
$Co_3(PO_4)_2$	410F/g	3 M KOH	52.9 % (8 A/g)	[7]
$Co_{11}(HPO_3)_8(OH)_6$	312 F/g (1.25 A/g)	-	63.4% (12.5 A/g)	[8]
$Mn_3(PO_4)_2$/GF	270 F/g (0.5 A/g)	6 M KOH	-	[9]
$NaNi_{0.33}Co_{0.67}PO_4 \cdot H_2O$	828 F/g	1 M KOH	88.7 % (10 A/g)	[10]
$CoHPO_4 \cdot H_2O$	411.2 F/g	2 M KOH	82 % (10 A/g)	[11]
$Ni_{11}(HPO_3)_8(OH)_6$	558 F/g (0.5 A/g)	3 M KOH	40.1 % (7 A/g)	[12]

Table S2 The R_s, R_{ct}, R_1 and W of sample before and after cycles.

Samples	R_s (Ω)	R_{ct} (Ω)	R_1 (Ω)	W
Before cycle	0.807	3.775	2.252	0.334
After cycle	0.870	3.860	0.133	4.777

References

1. D. H. Lee, M. Kang, S.-M. Paek and H. Jung, Bulletin of the Korean Chemical Society, 2016, 37, 192-199.
2. Y. Zhang, M. Zheng, M. Qu, M. Sun and H. Pang, Journal of Alloys and Compounds 2015, 651, 214-221.
3. L. Bing, G. Peng, F. Yongcheng, Z. Guangxun, H. Kesheng, X. Huaiguo and P. Huan, Advanced Functional Materials, 2017, 1605784.
4. H. Mao, Y. Qian, Z. Jin and Y. Zhang, Materials Letters, 2018, 228, 258-261.
5. J. Theerthagiri, K. Thiagarajan, B. Senthilkumar, Z. Khan, R. A. Senthil, P. Arunachalam, J. Madhavan and M. Ashokkumar, ChemistrySelect, 2017, 2, 201-210.
6. H. Li, H. Yu, J. Zhai, L. Sun, H. Yang and S. Xie, Materials Letters, 2015, 152, 25-28.
7. H. Mao, F. Zhang, X. Liu, J. Qiu, B. Li and Z. Jin, Journal of Materials Science: Materials in Electronics, 2018, 29, 16721-16729.
8. H. Pang, Y. Liu, J. Li, Y. Ma, G. Li, Y. Ai, J. Chen, J. Zhang and H. Zheng, Nanoscale, 2013, 5, 503-507.
9. A. A. Mirghni, M. J. Madito, T. M. Masikhwa, K. O. Oyedotun, A. Bello and N. Manyala, J

Colloid Interface Sci, 2017, 494, 325-337.
10. M. Liu, N. Shang, X. Zhang, S. Gao, C. Wang and Z. Wang, Journal of Alloys and Compounds, 2019, 791, 929-935.
11. Y. Wang, W. Li, L. Zhang, X. Zhang, B. Tan, J. Hao, Z. Jian, X. Wang, Q. Hu and X. Lu, Journal of Power Sources, 2020, 227487.
12. Y. Gao, J. Zhao, Z. Run, G. Zhang and H. Pang, Dalton Trans, 2014, 43, 17000-17005.