Electronic Supplementary Material (ESI) for Sustainable Energy & Fuels.

Nanoflower $Ni(OH)_2$ grown *in-situ* on Ni foam for high-performance supercapacitor electrode materials

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label	Mole ration (Ni source：urea：NH_4F)	Additive	Temperature	Hours	XRD	Mass of active material on an electrode(mg/cm²)	Capacitance (CV/5mv s^{-})	Capacitance(charging-discharging/ 3 mA g^{-})
αlpha-1	1:2 (0.712g NiCl2-0.360g urea)	no	200	12h	α	4.8	1018	2593
αlpha-2	1:2 (0.8724g Ni(NO3)2-0.360g urea)	no	200	12h	α	2.4	1061	2814
αlpha-3	1:2 (0.8724g Ni(NO3)2-0.360g urea)	no	200	5h	α	1.7	816	656
beta-1	1:2:2 (0.8724g Ni(NO3)2-0.360g urea)	NH_4F	200	5h	β	1.3	253	394
beta-2	1:5:2 (0.6979g Ni(NO3)2-0.7212g urea)	NH_4F	200	5h	β	1.7	413	620
beta-3	1:4:0.7 (0.1452g Ni(NO3)2-0.120g urea)	NH_4F	200	5h	β	0.8	735	1011

Table S1 Samples prepared under different experimental conditions.

α-Ni(OH)2	2theta	12.5	24.9	33.7	59.6	-----	-----
	hkl	(003)	(006)	(101)	(110)	-----	-----
β-Ni(OH)2	2theta	19.6	33.4	38.8	52.2	59.2	62.7
	hkl	(001)	(100)	(101)	(102)	(003)	(111)

Table S2 List of main observed reflection (2-theta) and hkl indices for α-$Ni(OH)_2$ and β-$Ni(OH)_2$ of this work.

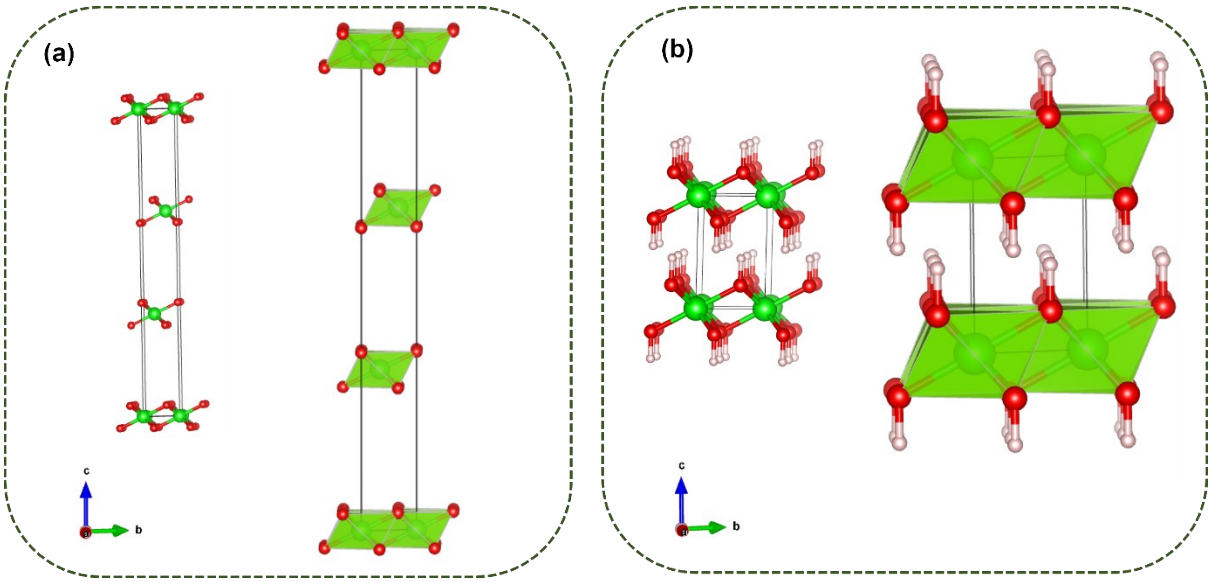

Figure S1 (a)The crystal structure of α-$Ni(OH)_2$. (b) The crystal structure of β-$Ni(OH)_2$. (Green spheres: Ni^{2+}; Red spheres: O^{2-}; White spheres: H^+)

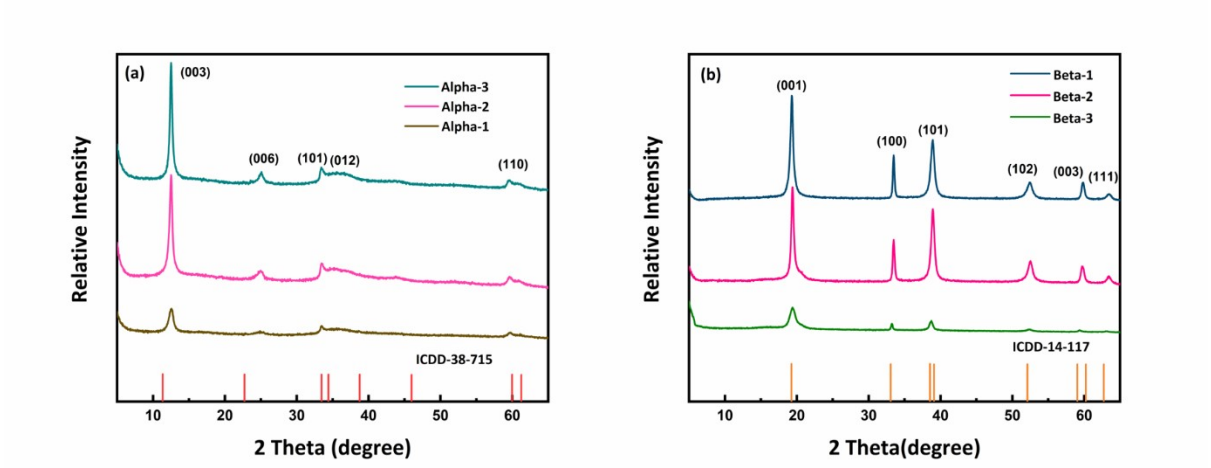

Figure S2 (a) PXRD pattern of β-$Ni(OH)_2$ compared to the standard pattern for ICDD 14-117. (b) PXRD patterns of α-$Ni(OH)_2$ to the standard pattern ICDD 38-715.

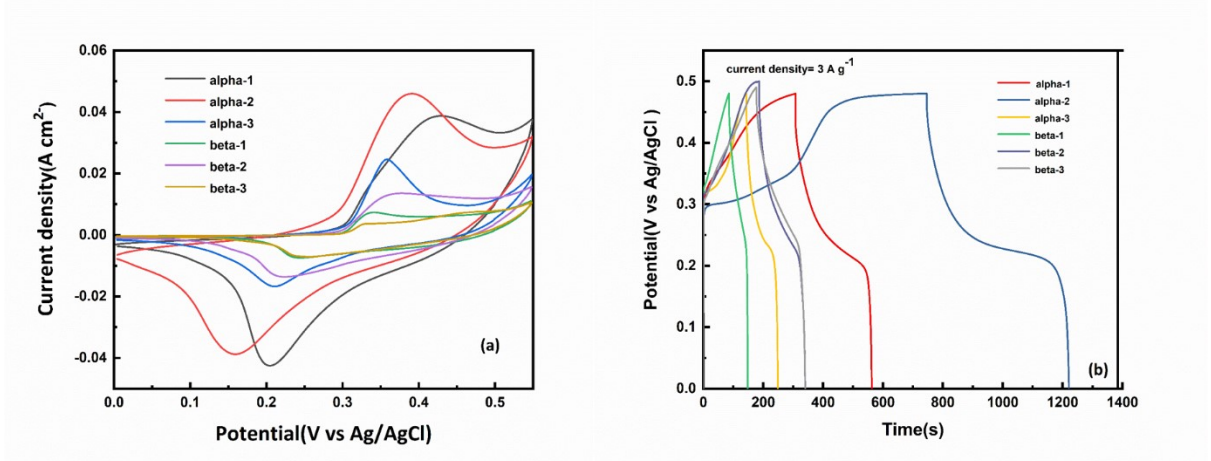

Figure S3 (a)CV curves of samples obtained from different experimental conditions at the 5 mv s^{-1}. (b) Galvanostatic charge-discharge curves of samples obtained from different experimental conditions at the 3 A g^{-1}.

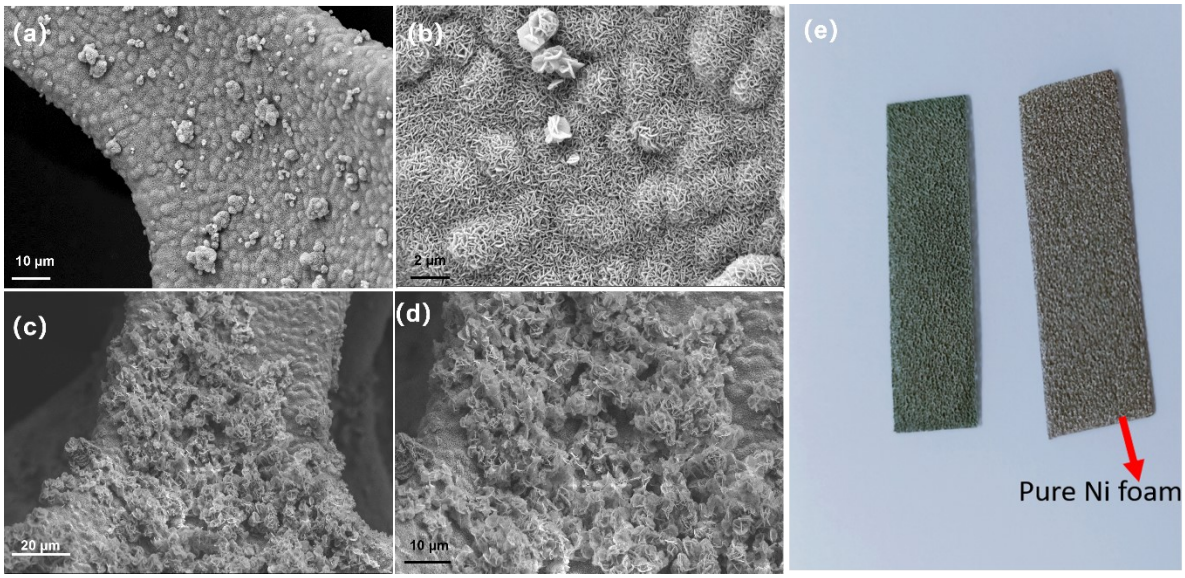

Figure S4 (a-b) SEM images of α-$Ni(OH)_2$ on Ni foam; (c-d) SEM images of β-$Ni(OH)_2$ on Ni foam; (e) digital photographs of Ni foam before (right) and after (left) hydrothermal treatment.

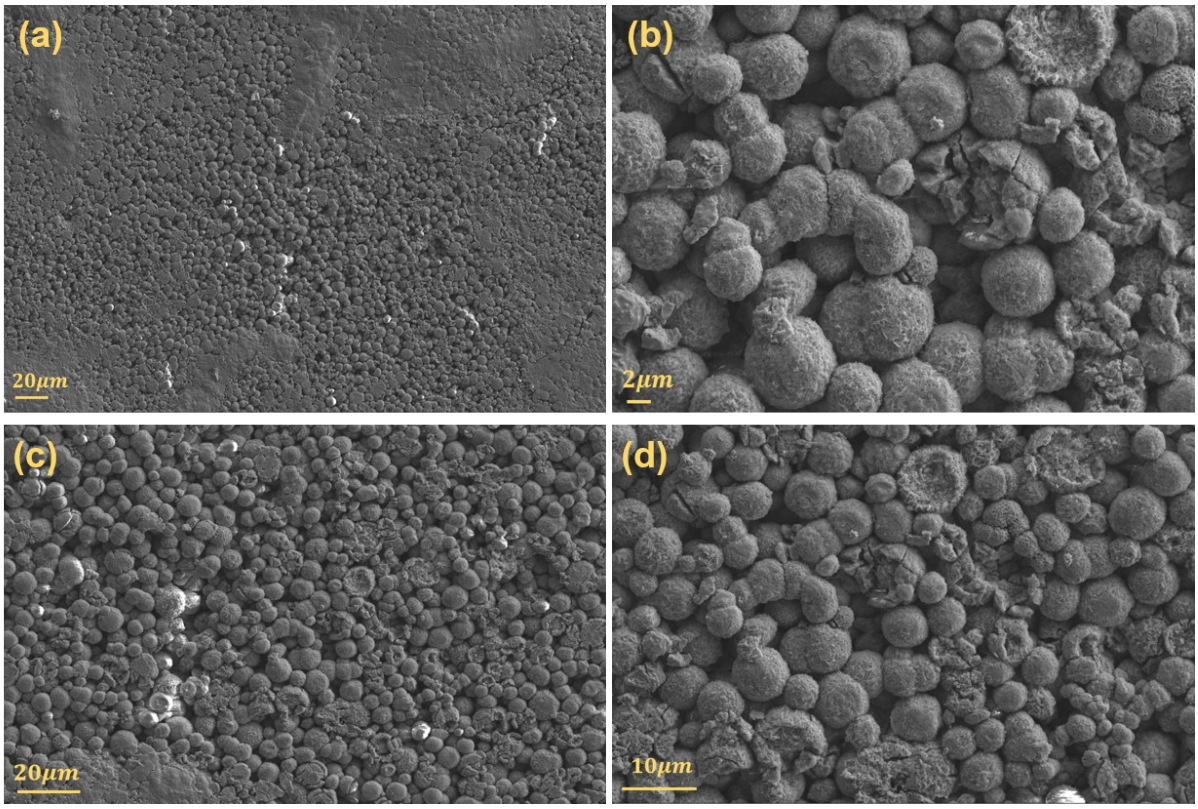

Figure S5 (a-d) SEM images of the α-2 sample on nickel foam after electrochemical test.

α-Ni(OH)2	3 A/g	4 A/g	6 A/g	8 A/g	10 A/g	20 A/g
Capacitance (F/g)	2814	2340	2022	1805	1642	1096
Capacity (C/g)	736	596	499	442	394	237

Table S3 the specific capacitance and capacity of α-$Ni(OH)_2$ from charge-discharge processes.

β-Ni(OH)2	3 A/g	4 A/g	6 A/g	8 A/g	10 A/g	20 A/g
Capacitance (F/g)	1011	926	871	787	724	539
Capacity (C/g)	230	261	243	218	199	138

Table S4 the specific capacitance of β-$Ni(OH)_2$ from the cyclic voltammetry.

Sample	Methods	Sample Specific capacitance(F g^{-1})	Current load or scan rate	Reference
α-Ni(OH)2	Hydrothermal	1715	5 mV s^{-}	1
α-Ni(OH)2	precipitation	805	5 mV s^{-}	2
α-Ni(OH)2	precipitation	1328	1 A g^{-}	3
α-Ni(OH)2	precipitation	2222	1 A g^{-}	4
α-Ni(OH)2	Electrochemical preparation	2301	1 A g^{-}	5
Zn doped is α-Ni(OH)2	Electrodepositio n	860	10 mA cm^{2-}	6
α-Ni(OH)2/graphene	microwave heating	1735	1 mV s^{-}	7
α-Ni(OH)2	Hydrothermal	2814	3 A g^{-}	This work

Table S5 The specific capacitance of α-$Ni(OH)_2$ from references applied in supercapacitors.

References:

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