Supplementary Materials: α- and β-Phase Ni-Mg Hydroxide for High Performance Hybrid Supercapacitors

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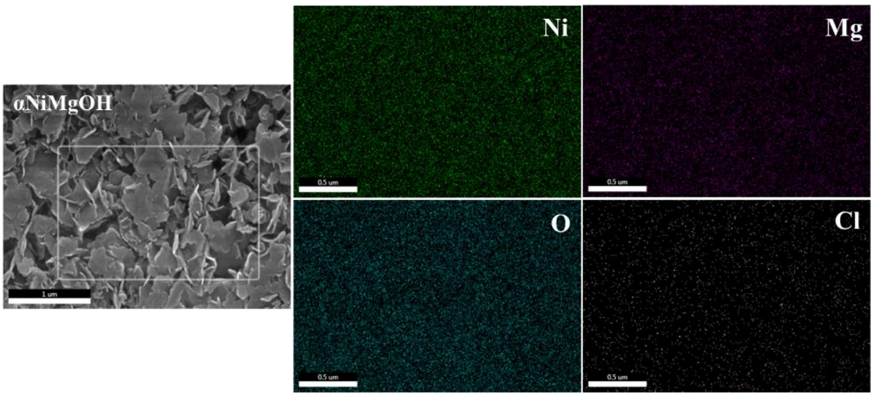


Figure S1. SEM and corresponding element mapping of α-NiMgOH.

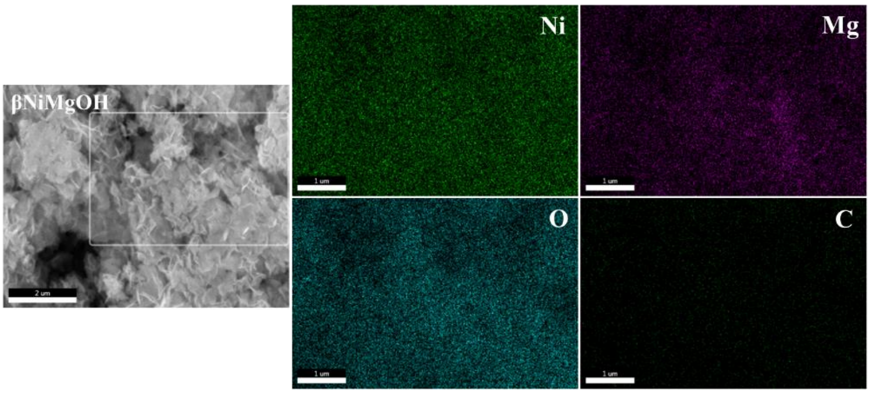


Figure S2. SEM and corresponding element mapping of β-NiMgOH.

Table S1. Summary of surface area

Sample	S_{Total}[a] (m^2/g)	V_{Total}[b] (cm^3/g)	S_{Micro}[c] (m^2/g)	S_{Exter}[d] (m^2/g)
α-NiMg-OH	290.88	0.0047	12.9	277.98
β-NiMg-OH	71.10	0.0063	12.72	58.39

a: S_{Total} represent BET surface area. **b**: V_{Total} represent t-Plot micropore volume. **c**: S_{Micro} represent t-Plot micropore area. **d**: S_{Exter} represent t-Plot external surface area.

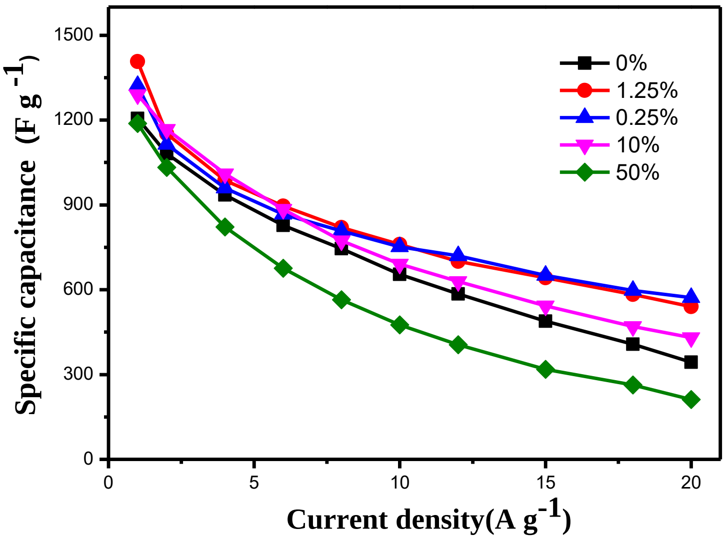
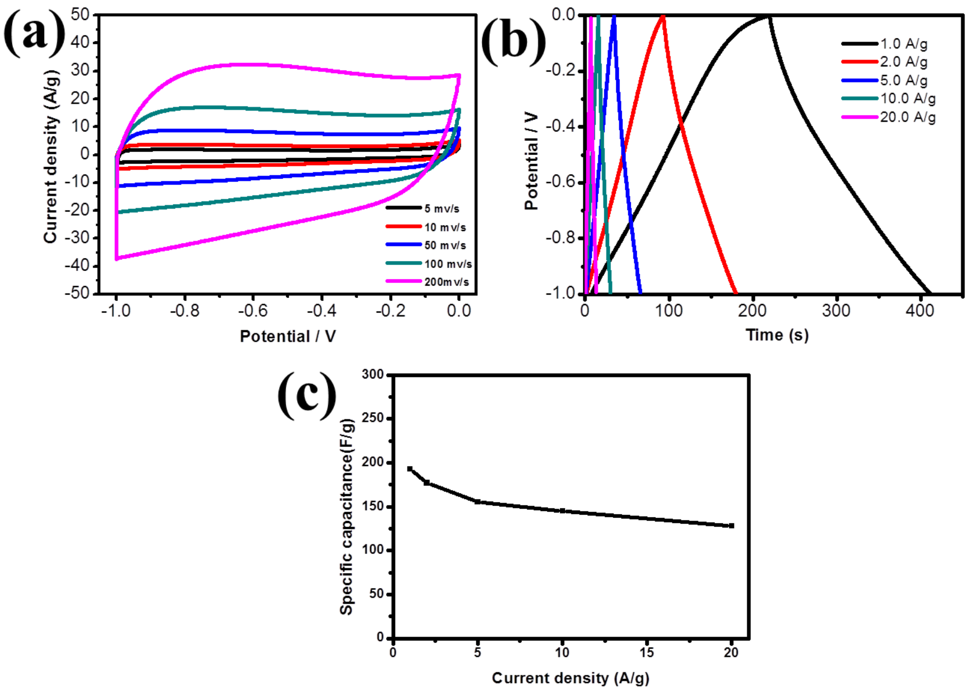


Figure S3. Specific capacitance of Mg doped $Ni(OH)_2$ with different content fabricated by precipitated method at different current densities

Synthesis process: The solution with different Mg content were mixed with $NiCl_2$ aqueous (0.5 mol/L) and $MgCl_2$ aqueous (0.5 mol/L). Then KOH aqueous solution (1.0 mol/L) was added the mixed solution with continuous stirring. The molar ratio of Mg^{2+} + $Ni^{2+}$and OH^- is 1:1. After the reactions were finished, the apple green precipitates were obtained by centrifugation (4,000 rpm, four minutes), rinsed with H_2O and EtOH, followed by freeze-drying at approximately −45°C.



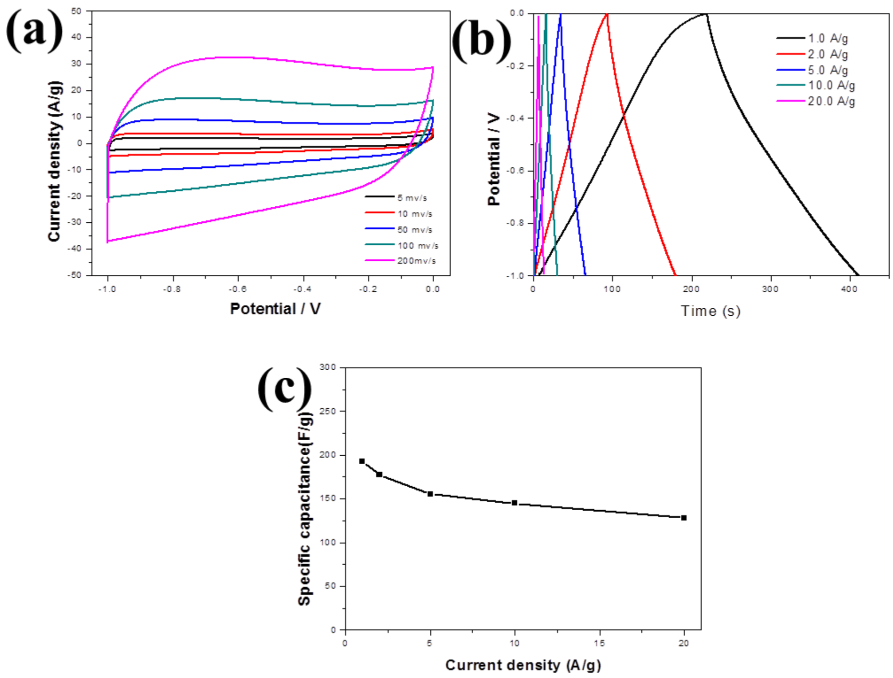


Figure S4. (**a**) GCD curves of AC at a range of current densities measured in a three-electrode device; (**b**) Charge-discharge curve of AC at a range of current densities; (**c**) Specific capacitance of AC at different current densities.

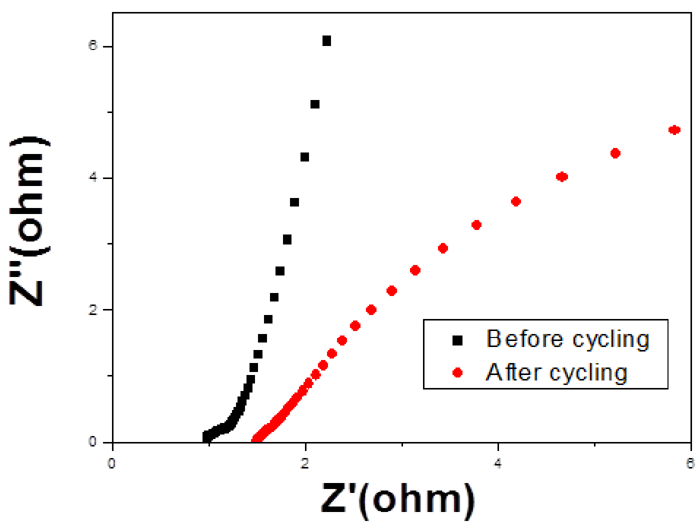


Figure S5. Nyquist plots of electrode α-NiMg-OH before and after charge-discharge cycling.

Table S2. Comparison between the supercapacitive performances of our work and the recent hydroxide nanomaterials from literatures.

Electrodes	Specific Capacitance (F/g)	Rate performance	Cycling performance	Reference
NiAl-LDH	735 (1 A/g)	75% (1-25 A/g)	116.5% (8 A/g, 1000 cycles)	[1]

NiMgAl-LDH	230.11 (2 A/g)	45.7% (1-3 A/g)	86.1% (5 A/g, 5000 cycles)	[2]
Ni-Al LDH/NNDG	1950 (1 A/g)	75% (1-10 A/g)	95% （10A/g, 10000 cycles）	[3]
NiAl-LDH	2123.7 (0.5 A/g)	50.5% (0.5-20 A/g)	91.9% (5 A/g, 10000 cycles)	[4]
NiMn-LDH/NDCF	2128.3 (0.5 A/g)	70% (0.5-10 A/g)	94.3% (2 A/g, 5000 cycles)	[5]
NiFe-LDH/RGO	1325 (5 A/g)	86.7% (5-20 A/g)	64.7% (15 A/g, 2000 cycles)	[6]
MgAl-LDH/RGO	1334 (1 A/g)	46% (1-10 A/g)	87% (5 A/g, 10000 cycles)	[7]
$Ni(OH)_2$	1567 (1 A/g)	25% (1-10 A/g)	90% (10 A/g, 600 cycles)	[8]
α--$Ni(OH)_2$	1759 (1 A/g)	50% (1-20 A/g)	90.3% (10 A/g, 1000 cycles)	[9]
Mg-$Ni(OH)_2$	1931 (0.5 A/g)	77% (0.5-20 A/g)	95% (10 A/g, 10000 cycles)	[10]
$Ni(OH)_2$	2606 (1 A/g)	44.5% (1-20 A/g)	~20% (10 A/g, 1200 cycles)	[11]
NiMg-OH	2602 (1 A/g) 1942 (1 A/g)	~70% (1-10 A/g)	78.5% (10 A/g, 1000 cycles) 87% (10 A/g, 1000 cycles)	This work

LDH: Layered Double Hydroxide
NNGO: Nitramine-N-Doped Graphene
NDCF: Nitrogen Doped Carbon Foams
RGO: Reduced Graphene Oxide

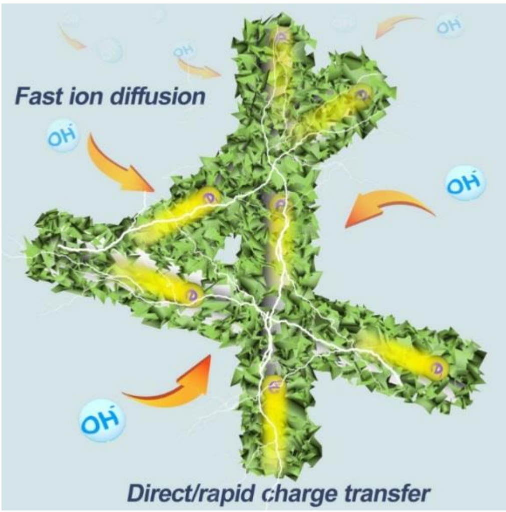


Figure S6. The schematic illustration of the advantages of α-NiMg-OH nanosheets electrode for supercapacitor properties.

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