Supporting Information

Biomass-Derived Three-Dimensional Honeycomb-Like Hierarchical Structured Carbon for Ultrahigh-Energy-Density Asymmetric Supercapacitors

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Figure S1.

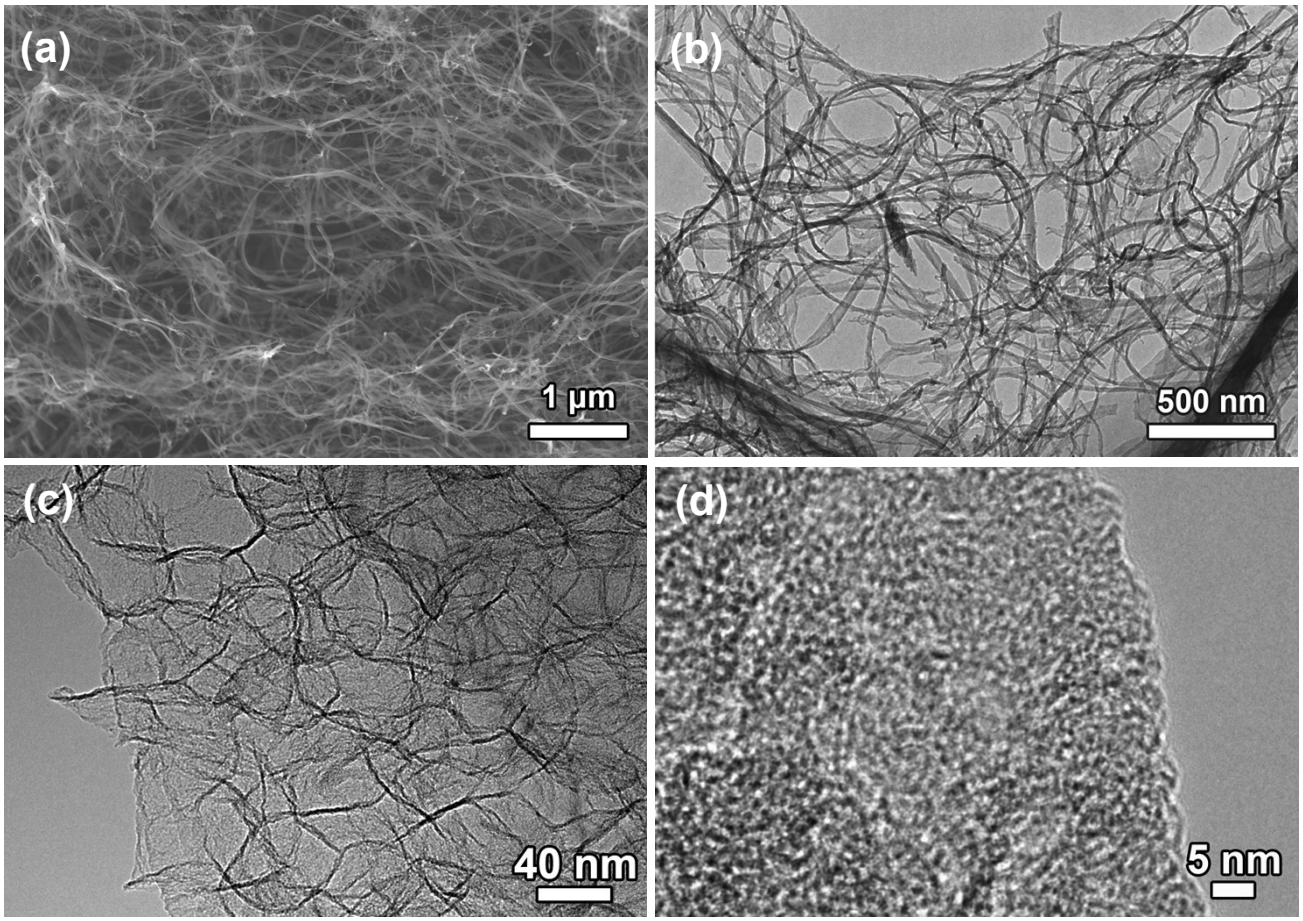

Figure S1. (a) SEM and (b-d) TEM images of the carbonized BC (a and b) and HSC-0.2 (c and d).

Figure S2.

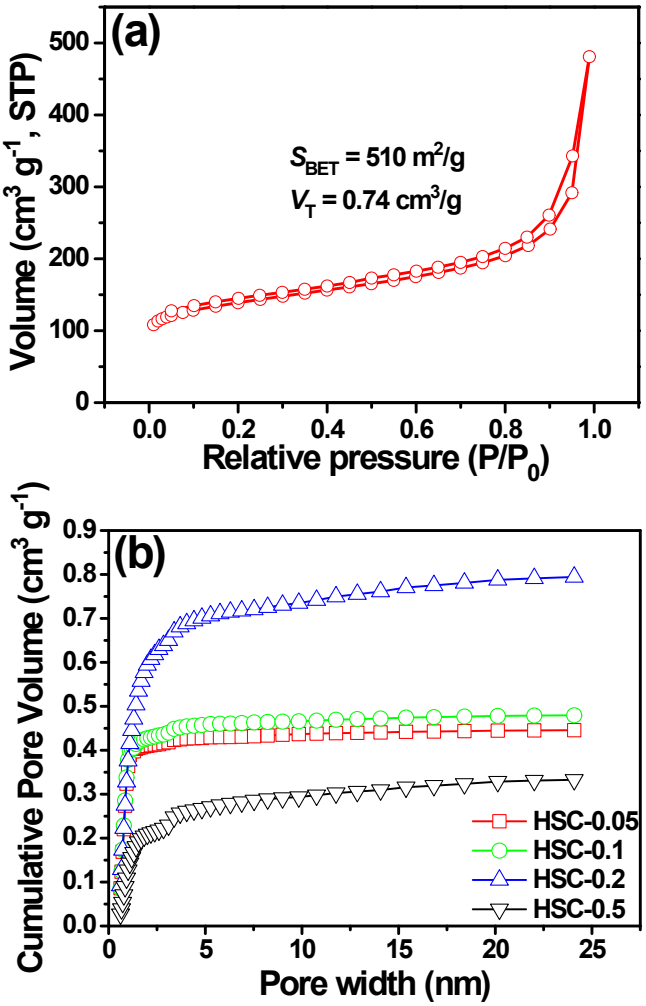

Figure S2. (a) N_2 adsorption/desorption isotherm of the carbonized BC. (b) Cumulative pore volume of the HSC samples.

Figure S3.

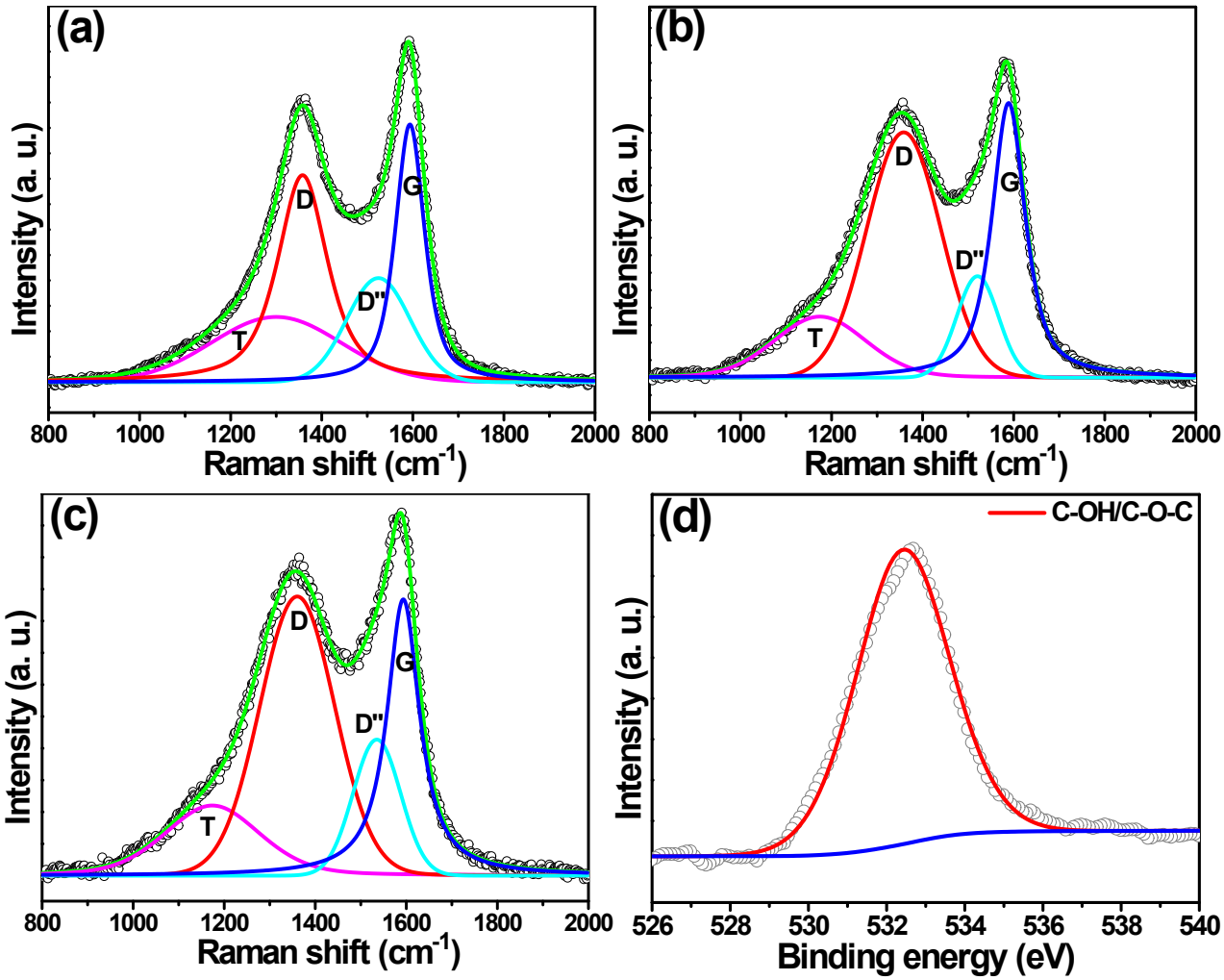

Figure S3. Raman spectra of (a) HSC-0.05, (b) HSC-0.1 and (c) HSC-0.5. (d) High-resolution O 1s spectrum of the HSC-0.2 sample.

Figure S4.

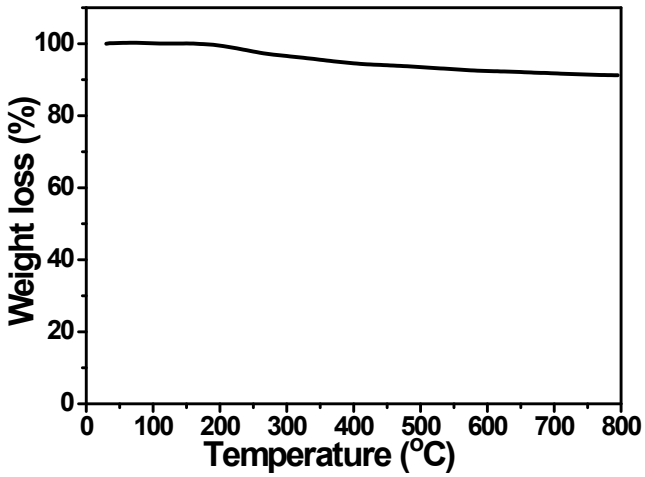

Figure S4. TGA curve of the HSC-0.2 sample.

Figure S5.

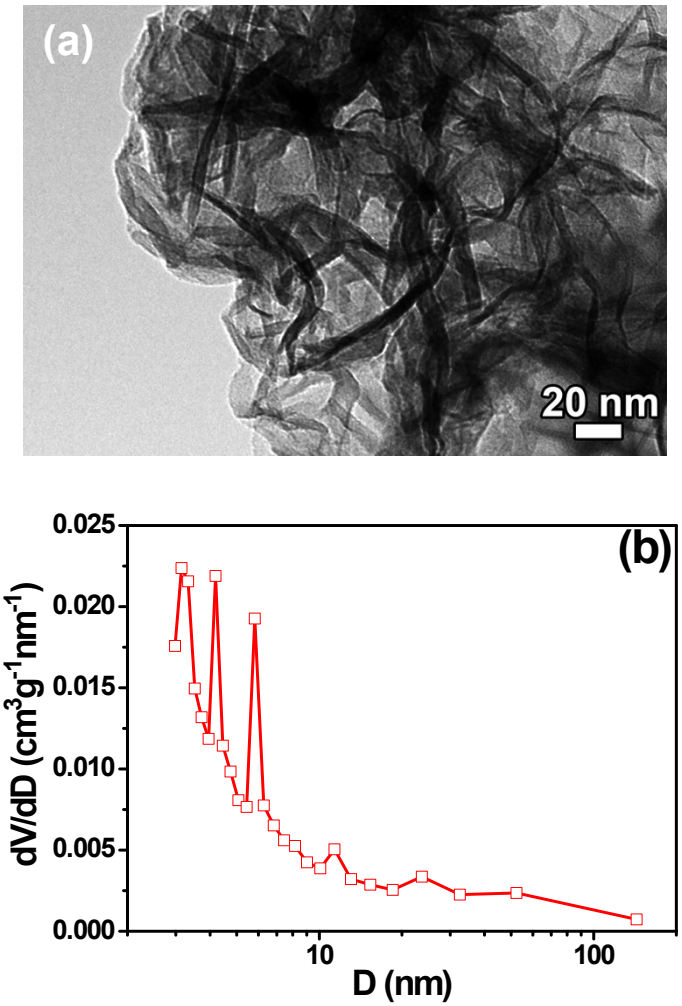

Figure S5. (a) TEM image and (b) Barrett-Joyner-Halenda (BJH) pore size distribution of the NiCoAl-LDH.

Fig. S6.

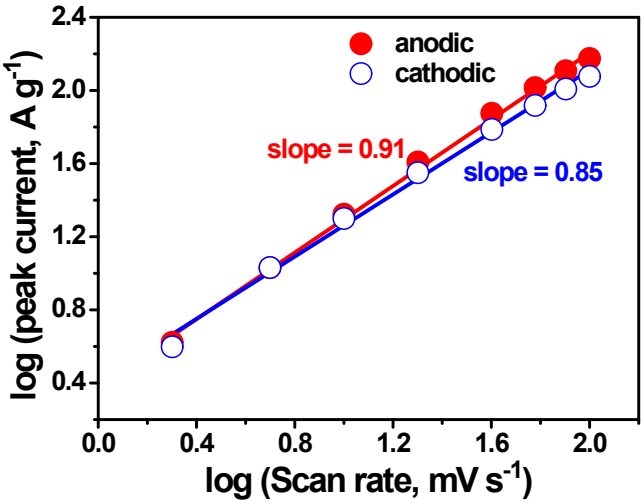

Fig. S6. The relationship between peak current and scan rates from 2 to 100 mV s^{-1} for the NiCoAl-LDH electrode.

Figure S7.

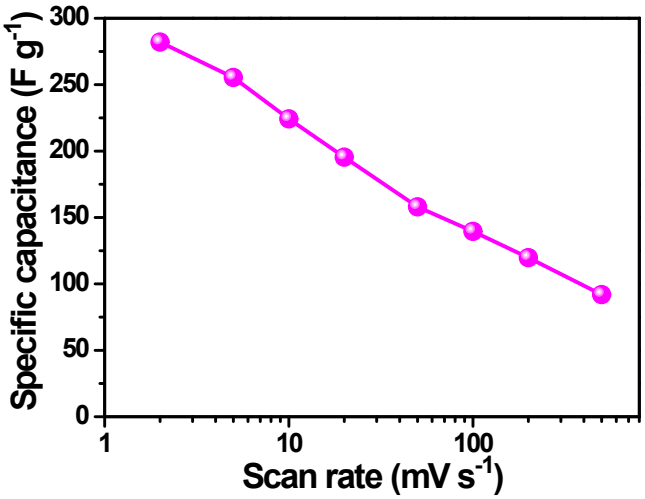

Figure S7. Specific capacitance of the fabricated NiCoAl-LDH//HSC-0.2 asymmetric supercapacitors at different scan rates.

Table S1. Comparison of the performance of NiCoAl-LDH with previously reported LDH materials.

Electrode	Scan rate	Capacitance (F/g)	Rate capability	Cycling life	Ref.
NiCo-LDH/ZTO	0.5 A/g	1805	70.6% (100 A/g)	92.7% (5000)	[1]
NiCo-LDH	1.0 A/g	1887	63.9% (10 A/g)	99.7% (3000)	[2]
NiCo-LDH	1.0 A/g	1372	67.8% (30 A/g)	91.2% (10000)	[3]
NiCo-LDH	3.0 A/g	2682	59.6% (20 A/g)	82% (5000)	[4]
NiCo-LDH	6.0 A/g	1734	66.1% (30 A/g)	86% (1000)	[5]
NiCo-LDH	1.0 A/g	1292	43.0% (50 A/g)	72% (3000)	[6]
NiCo-LDH/CNTs	1.0 A/g	1151	61.0% (70 A/g)	77% (10000)	[7]
CBC/NiCo-LDH	1.0 A/g	1950	54.7% (20 A/g)	74% (5000)	[8]
NiMn-LDH/graphene	1.0 A/g	2246	59.4% (20 A/g)	67% (1500)	[9]
NiMn-LDH	1.0 A/g	1725	57.5% (20 A/g)	44% (1500)	[9]
NiCo-LDH/CTs	2.0 A/g	2105	83.1% (6 A/g)	90% (2000)	[10]
NiCoMn-LDH	1 mA/cm^2	1400	95% (100 mA/cm^2)	117% (3000)	[11]
CoAl-LDH	1.0 A/g	1043	87.4% (20 A/g)	88% (3000)	[12]
NiCoAl-LDH/graphene	1.0 A/g	1866	72.9% (10 A/g)	100% (5000)	[13]
NiCoAl-LDH	1.0 A/g	1297	59% (30 A/g)	97% (10000)	[14]
NiMn-LDH	1 mA/cm^2	160	—	85% (1200)	[15]
CoAl-LDH/CNTs	0.86 A/g	884	59.8% (4.3 A/g)	88% (2000)	[16]
Fe_3O_4@C@NiAl-LDH	1.0 A/g	767.6	59.8% (10 A/g)	92% (1000)	[17]
NiCoAl-LDH/CNT/graphene	1.0 A/g	1188	72% (10 A/g)	100% (1000)	[18]
NiMn-LDH/CNTs	1.5 A/g	2960	79.5% (30 A/g)	97.2% (2000)	[19]
NiAl-LDH/graphene	3.57 A/g	1329	64% (17.86 A/g)	91% (500)	[20]
NiAl-LDH/graphene	0.1 A/g	1730.2	45.7% (10 A/g)	99.2% (500)	[21]
NiAl-LDH/graphene	1.0 A/g	2712.7	43.3% (50 A/g)	98.9% (5000)	[22]
NiAl-LDH	0.5 A/g	795	25.4% (10 A/g)	80% (1000)	[23]
CoAl-LDH@PEDOT	2 mV/s	649	68.6% (40 mV/s)	92.5% (5000)	[24]
NiCoAl-LDH/CNTs	1.0 A/g	1035	57.7% (10 A/g)	83.2% (1000)	[25]
CoAl-LDH/graphene	1.0 A/g	711.5	72.6% (10 A/g)	81% (2000)	[26]
NiAl-LDH	2.0 A/g	735	75% (25 A/g)	105.6% (1000)	[27]
NiAl-LDH	1.8 A/g	814	50.2% (18 A/g)	95% (400)	[28]
CoAl-LDH/GO	1.0 A/g	1031	24.2% (20 A/g)	100% (6000)	[29]
CoMn-LDH	0.7 A/g	1063	69.1% (28.6 A/g)	96.3% (5000)	[30]
NiCo-LDH	0.5 A/g	1537	76.8% (10 A/g)	80.3% (1000)	[31]
NiCoAl-LDH	**2 mV/s**	**1480**	**66.5% (100 mV/s)**	**89.5% (10000)**	**This work**

Table S2. Performance comparison of NiCoAl-LDH//HSC-0.2 ASC with previously reported ASCs in aqueous electrolytes.

ASCs	Electrolyte	Voltage window (V)	Energy density (Wh/kg)	Ref.
NiCo-LDH/ZTO//AC	2 M KOH	1.2	23.7	[1]
NiCo-LDH//AC	2 M KOH	1.5	25.3	[3]
NiCo-LDH//graphene	1 M KOH	1.6	53	[4]
CBC/NiCo-LDH//CBC	6 M KOH	1.6	36.3	[8]
CoAl-LDH//SGC	6 M KOH	1.6	41.2	[12]
NiCoAl-LDH//AC	6 M KOH	1.6	58.9	[14]
CoAl-LDH/CNTs//AC	2 M KOH	1.6	28	[16]
NiMn-LDH/CNTs//graphene	Nafion/KOH	1.7	88.3	[19]
CoAl-LDH/graphene//AC	6 M KOH	1.75	35.5	[32]
NiP@CoAl-LDH//AC	2 M KOH	1.6	37.2	[33]
NiAl-LDH/graphene//AC	1 M KOH	1.6	15.4	[34]
CoMn-LDH//AC	1 M LiOH	1.8	5.9	[30]
NiAl-LDH//porous graphene	6 M KOH	1.6	30.2	[35]
NiAl-LDH/CNT//AC	2 M KOH	1.8	52	[36]
CoAl-LDH//graphene	6 M KOH	1.6	34.7	[37]
NiCo-LDH//PPy	1 M KOH	1.3	61.3	[38]
CoAl-LDH//AC	2 M KOH	1.6	27.3	[39]
CoAl-LDH/graphene//AC	6 M KOH	1.4	28	[40]
NiCo-LDH//mesoporous carbon	6 M KOH	1.5	33.7	[31]
CoAl-LDH/MnO_2//AC	1 M LiOH	1.8	34.2	[41]
NiCo-LDH//FeOOH	3 M KOH	1.5	86.4	[42]
ZnO@$Ni(OH)_2$//CFs	6 M KOH	1.6	57.6	[43]
CF@$ZnCo_2O_4$//CFs	KOH/PVA	1.6	49.5	[44]
$MnCo_2O_4$@$Ni(OH)_2$//AC	2 M KOH	1.6	48	[45]
$Ni(OH)_2$/graphene//graphene	2 M KOH	1.6	75	[46]
$Ni(OH)_2$/CNTs//AC	6 M KOH	1.8	50.6	[47]
$Ni(OH)_2$/CNT/PEDOT//rGO/CNTs	1 M KOH	1.5	58.5	[48]
$Ni(OH)_2$/rGO//rGO	6 M KOH	1.6	77.8	[49]
NiCoAl-LDH//HSC-0.2	**6 M KOH**	**1.6**	**100**	**This work**

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