

Nickel hydroxide - coated 3D porous graphene hollow sphere framework as high performance electrode materials for supercapacitors

Fengqiao Zhang[§], Dong Zhu[§], Xi'an Chen^{}, Xin Xu, Zhi Yang, Chao Zou, Keqin Yang, Shaoming Huang^{*}*

Nanomaterials and Chemistry Key Laboratory, Wenzhou University, Wenzhou, China.

*Corresponding author E-mail: smhuang@wzu.edu.cn (Shaoming Huang), xianchen@wzu.edu.cn (Xi'an Chen); [§]These authors contributed equally to this work and share first authorship.

Experimental

Preparation of 2D reduced graphene oxide (2DG)

Graphene oxide (GO) was first synthesized from natural graphite powders (325 mesh, Sinopharm Chemical Reagent Co., Ltd.) by a modified Hummers method reported in previous study³⁴. Then 30 ml GO solution (1mg ml⁻¹) was freeze-dried for 24h. After that, GO powder was heated at 550 °C for 2h under Ar atmosphere with the heating rate of 20 °C / min to yield the corresponding reduced graphene oxide (2DG).

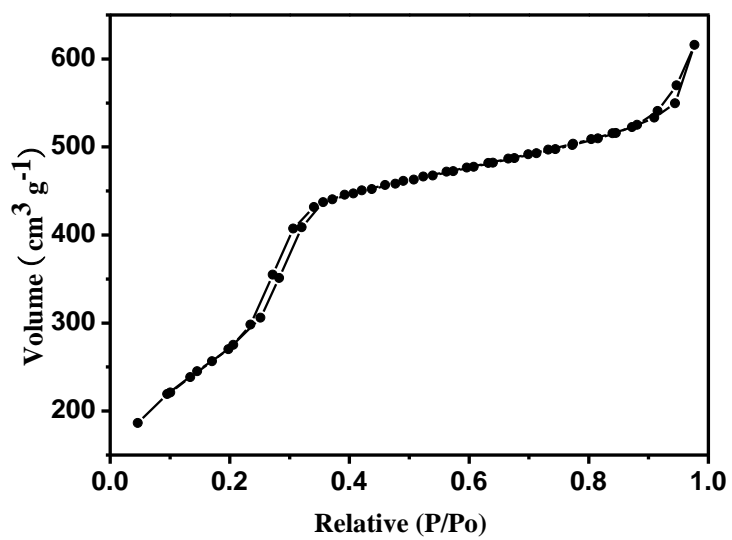


Fig. S1 N₂ adsorption and desorption isotherms on the PGHS.

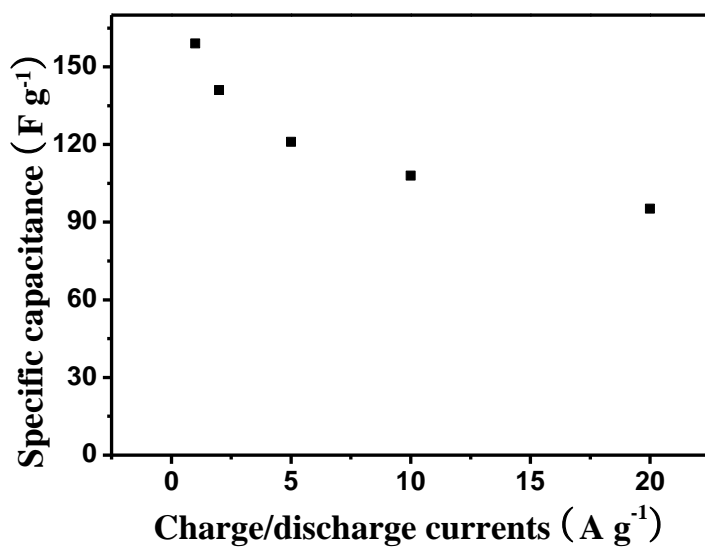


Fig. S2 Calculated specific capacitance from the charge/discharge curves of fig. 5d.

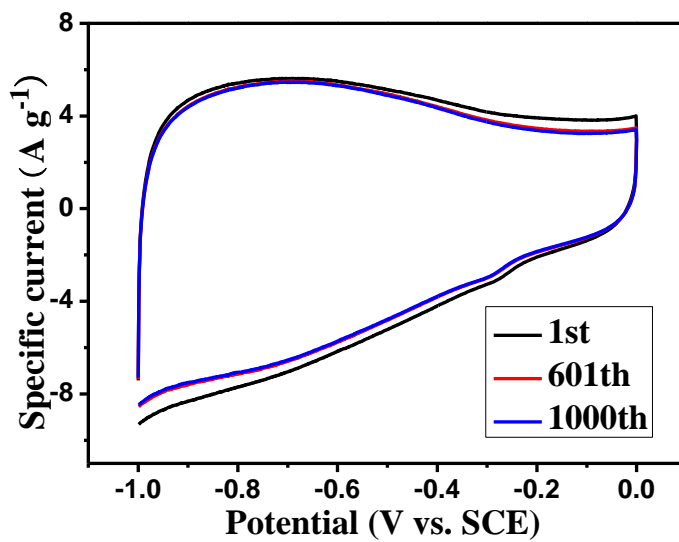


Fig. S3 CV test of PGHS from 1 to 1000 cycles at a scan rate of 30 mV s⁻¹.

Table S1 A comparison of specific capacitance between this study and some Ni(OH)₂-based electrodes reported in previous literature.

Electrode materials	C _{Ni(OH)₂} ^a	C _{total} ^b	Scan rate (mV s ⁻¹)	Ref
This study	2815	1319	5	--
	2759	1295	10	
VACNT-graphene/ Ni(OH) ₂	1384	803	5	33
	1230	730	10	
Porous graphene/ Ni(OH) ₂ hydrogels	3238	1250	10	21
Graphene/ Ni(OH) ₂ hydrogels	~1540	1247	5	22
Graphene/ Ni(OH) ₂ nanoplates	1267	887	5	16
Graphene/ Ni(OH) ₂	~1750	1450	5	18
Spherical Ni(OH) ₂ / Graphene	~1840	1750	5	20
Reduced graphene oxide/ Ni(OH) ₂	~1280	1215	5	17

^a The specific capacitance calculated based on the mass of Ni(OH)₂; ^bThe specific capacitance calculated based on the total mass; ~These values are not obtained directly, and calculated based on the proportion of Ni(OH)₂ and carbon materials referred in the literature.

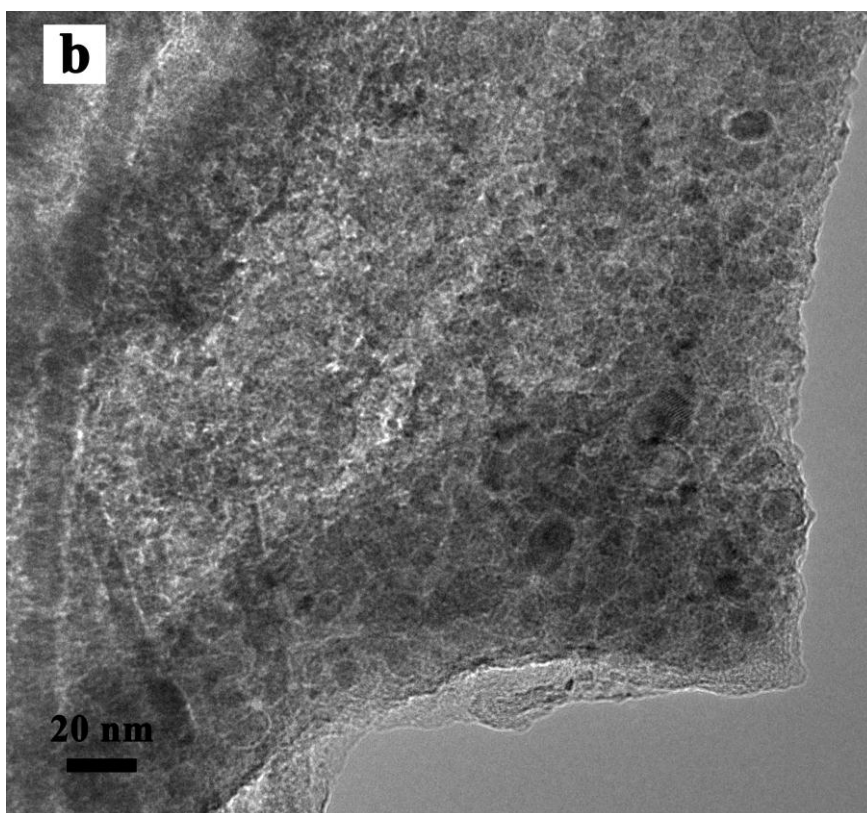
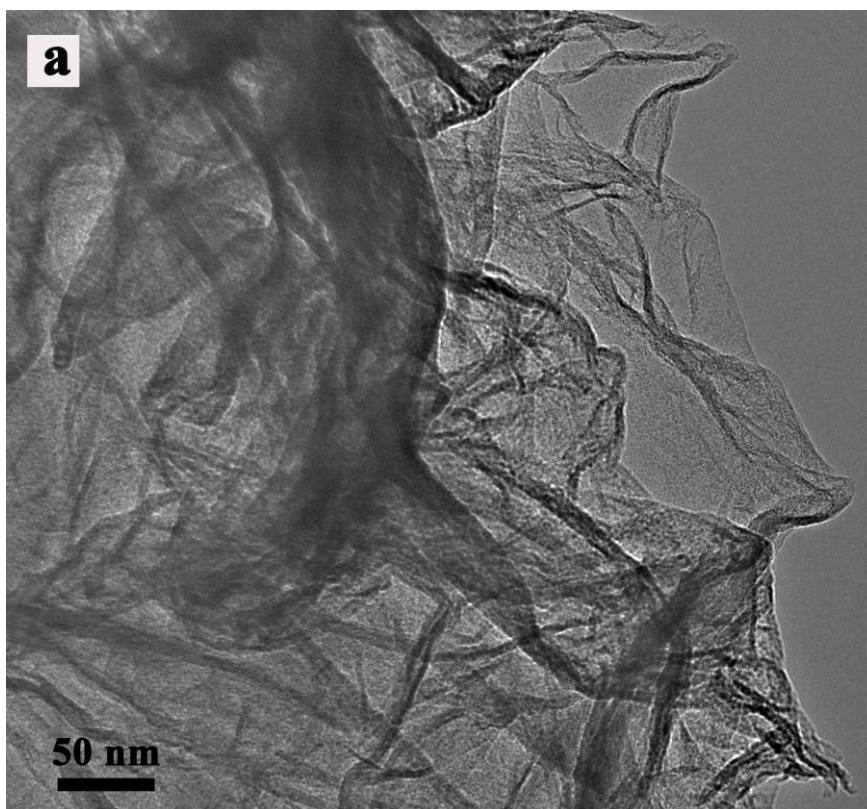


Fig. S4 TEM images at different magnifications of GNi2.

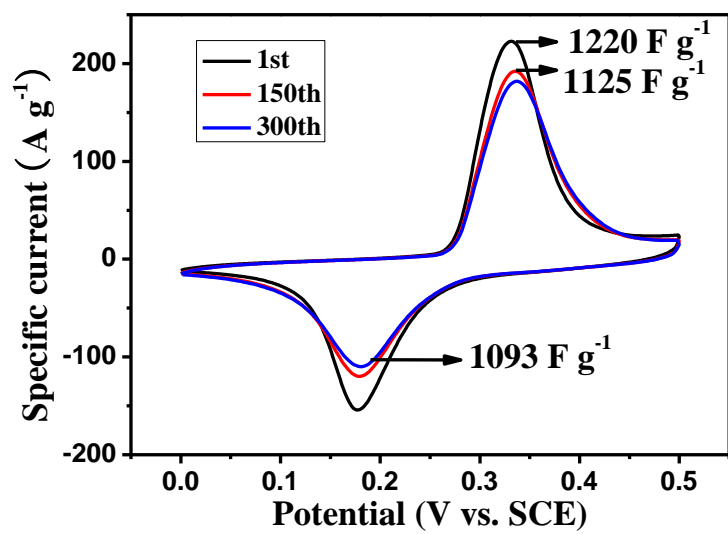


Fig. S5 CV test of PGHSNi12 after coated with nafion solution from 1 to 300 cycles at a 30 mV s⁻¹ scan rate