

Renewable pine cone biomass derived carbon materials for supercapacitor application

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Table S1: Elemental analysis of APC sample carbonized at 800 °C.

Sample	C at.%	N at.%	O at.%	K at.%
APC	94.9 ± 0.3	<1.0	4.0 ± 0.3	<1.0

Table S2. XPS peak fitting results for APC sample carbonized at 800 °C.

Region	BE [eV]	FWHM [eV]	Fraction	Assigned to	Reference
C 1s	284.6	1.2	0.37	C-C	1
	285.2	1.6	0.38	CH _x	2
	286.8	2.0	0.09	C-O-/C-N	1
	288.5	1.9	0.05	COO	1
	290.7	2.0	0.04	Na ₂ CO ₃	3
	293.8 (296.5)	2.0 (2.0)	0.07	Potassium oxide/hydroxide	
N 1s	398.5	1.8	0.42	Pyridine/Amine	4
	400.3	1.8	0.58	Nitrile/Pyrrole	4
O 1s	531.0	2.1	0.20	Potassium oxide/hydroxide	5
	532.2	2.2	0.61	oxide/hydroxide	1
	533.8	2.2	0.19	C-O- COO	1

Table S3 Fitting parameters for the equivalent circuit

R _s	Q	C ₁	C ₂	R _{CT}
(Ω)	(F.s ^(a-1))	(F)	(F)	(Ω)
1.47	0.066	0.004	0.118	1.75

$$\chi^2 = 0.005, \chi/\sqrt{N} = 0.01,$$

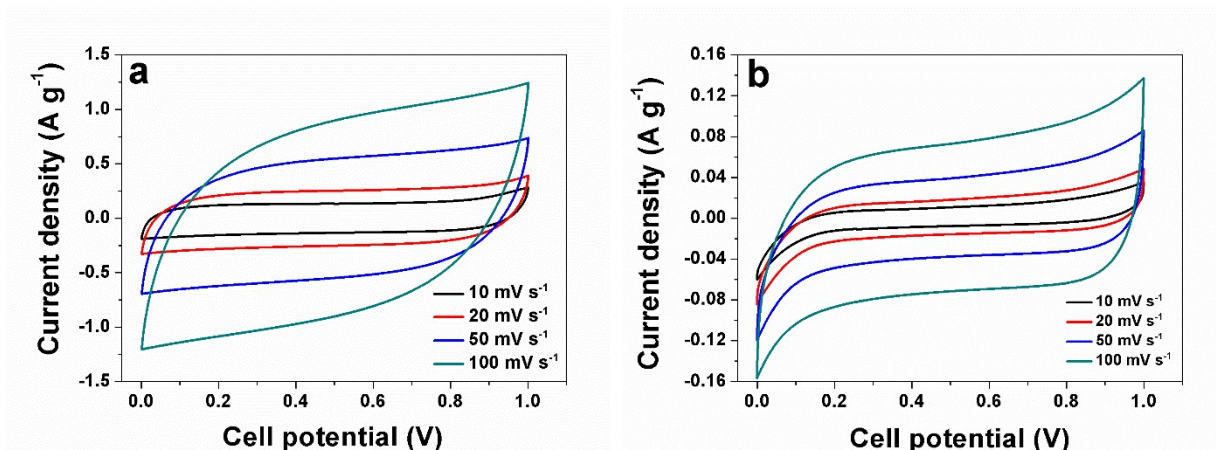


Figure S1 Electrochemical performance of (a) CV curves of APC-700 °C; (b) CV curves of APC-900 °C devices at different scan rates.

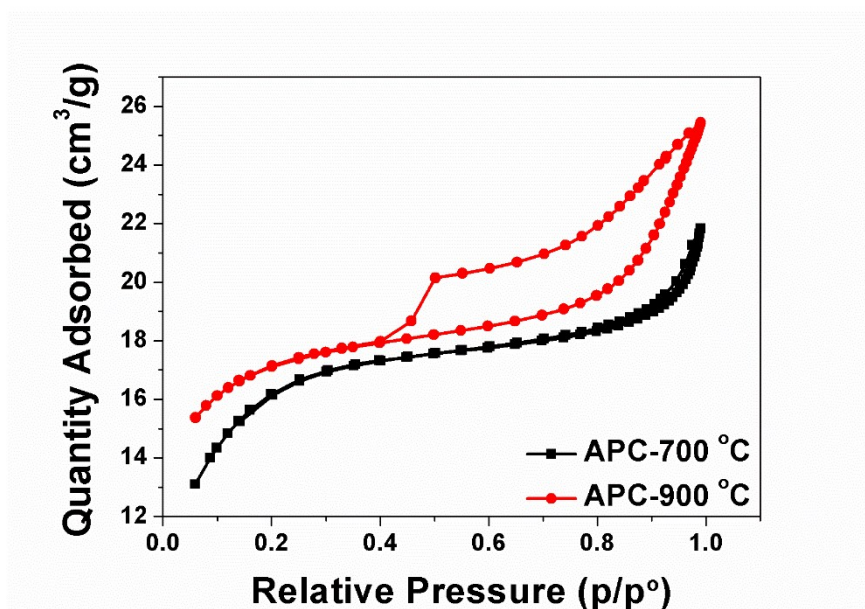


Figure S2 N_2 isotherm of APC-700 °C and APC-900 °C materials.

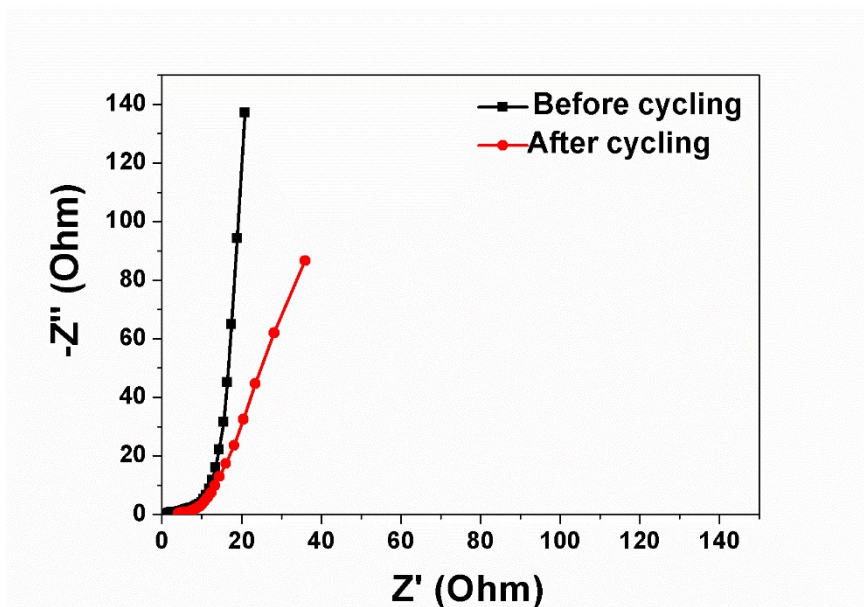


Figure S3 Nyquist plot before and after cycling

Reference

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