# Comparison of ionic liquid electrolyte to aqueous electrolytes on carbon nanofibres supercapacitor electrode derived from oxygen-functionalized graphene

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## Supporting information

## Experimental

*Synthesis of sheet-like reduced graphene oxide (RGO)*

Briefly, the sheet-like RGO was synthesized at room temperature using a modified Hummers method by adding graphite powder (1.0 g) and $KMnO_4$ (6.0 g) into a beaker containing 120 mL of concentrated sulphuric acid ($H_2SO_4$) (95-99.9%), and subsequently with 30% $H_2O_2$ (10 mL) and DI water (100 mL) to subdue residual permanganate and $MnO_2$ mixture to a colourless soluble manganese sulphate. Presto, the mixture became very hot with noticeable effervescence evolving a gas suspected to be oxygen. The resulting mixture was re-dispersed in DI water and sonicated for 2 h, and then centrifuged to have the precipitate, which was freeze-dried using a VirTis Model 4KBZL 105 Bench Top Pro freeze-drier.

## Results and discussion

| Element | Atomic conc. [%] | Error [%] | Mass conc. [%] | Error [%] |
|---|---|---|---|---|
| C 1s | 73.58 | 0.37 | 67.64 | 0.42 |
| O 1s | 26.42 | 0.37 | 32.36 | 0.42 |

**Table S1.** XPS elemental analysis of the carbon nanofibre.

*Standard three-electrode evaluations of single electrodes*

The single electrode materials were fabricated by mixing active material (80 wt. %) with conductive carbon (10 wt. %) and N-methyl-2-pyrrolidone (NMP) to make slurry, as stated in the main manuscript. The slurry was pasted onto the nickel foam used as current collector and then dried at 60 °C overnight. The cyclic voltammetry (CV) assessment of the three-electrode materials was done using a counter electrode made of glassy carbon, an Ag/AgCl/3 M KCl reference electrode, and the active materials on nickel foam stubs serving as the working electrodes in 1 M $Na_2SO_4$, 6 M KOH and ILE electrolytes at room temperature. The loading mass of each of the active materials was estimated to be ~ 3.0 mg.

The single electrode specific capacitance, $C_s$ (F $g^{-1}$) was evaluated via the CV curves using the equation ES1 below:

$$C_s = \frac{1}{mS_c\Delta V}\int_{v_1}^{v_2} IdV \qquad \text{(ES1)}$$

where, $v_1$ and $v_2$ are the peak potentials, I (mA) is the current response, $\Delta V$ (V) is the electrode potential, $S_c$ (mV $s^{-1}$) as the scan rate and m (g) is the mass of the active material.

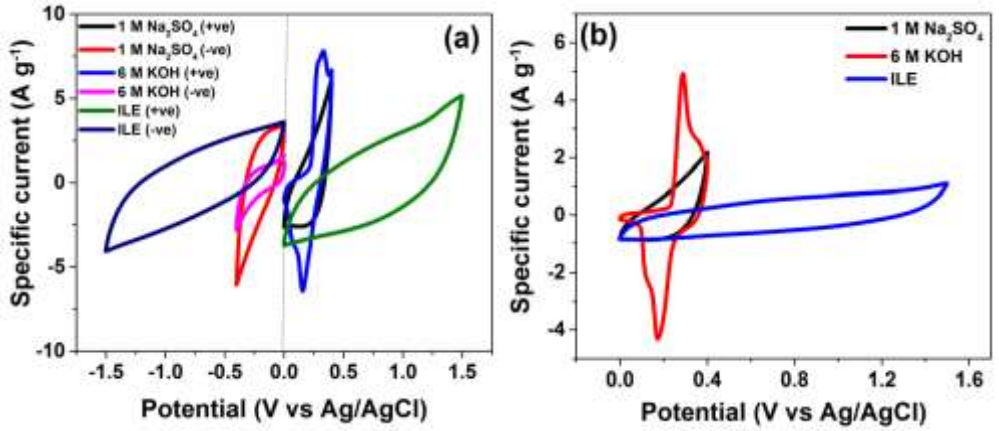


**Fig. S1.** (a) CV curves of carbon nanofibres electrode, and (b) CV curves of freeze-dried RGO electrode measured as a half-cell at a scan rate of 50 $mVs^{-1}$ in $Na_2SO_4$, 6 M KOH, and ILE electrolytes, respectively.

*Electrochemical analysis of the symmetric full-cell electrodes*

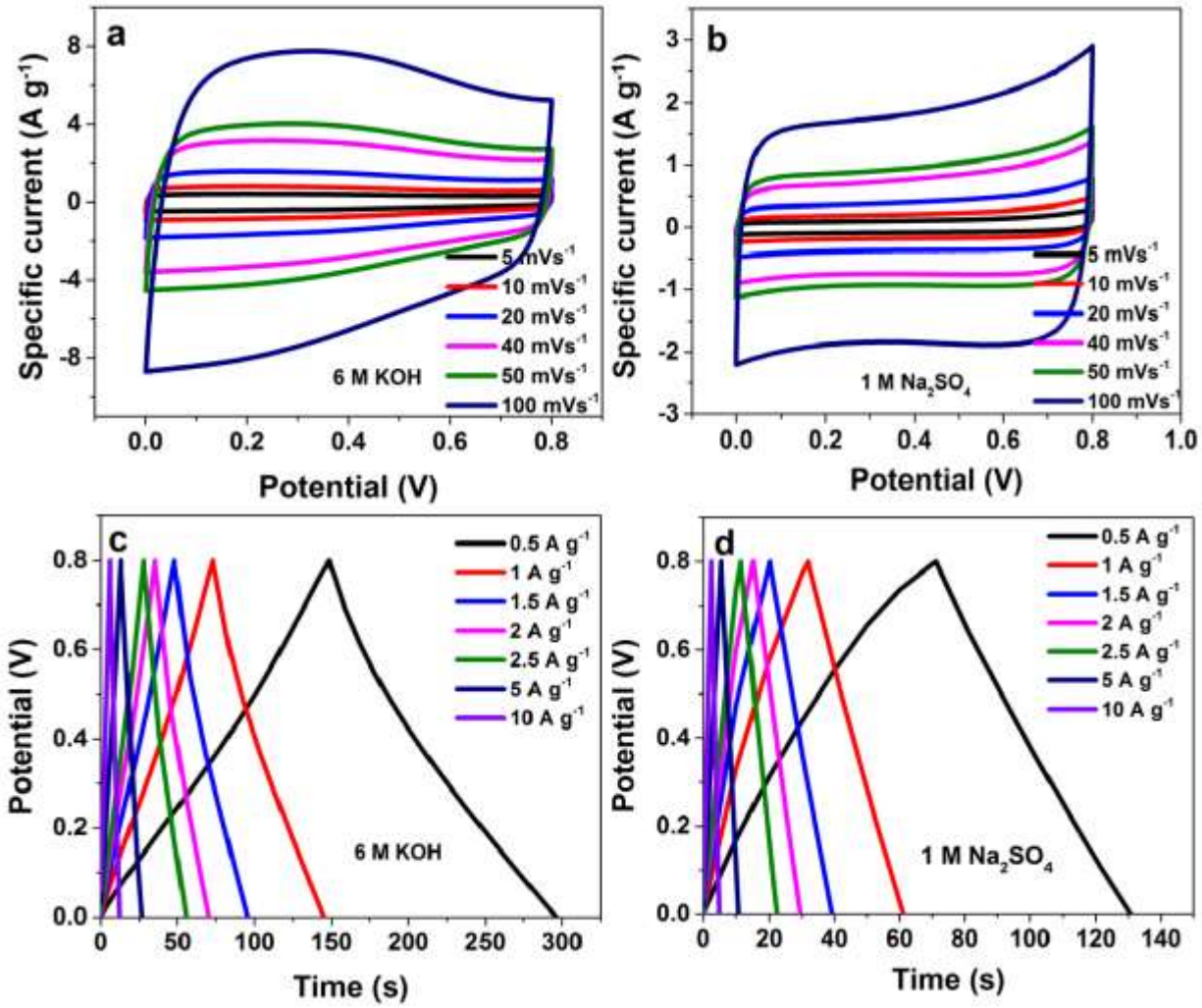


**Fig. S2.** CV and CD curves of carbon nanofibres in (a and c) 6 M KOH, and (b and d) 1 M $Na_2SO_4$ aqueous electrolytes, respectively, at different specific currents.