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Novel thermally reduce graphene oxide microsupercapacitor fabricated via mask-free axi-draw direct writing

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We demonstrate a simple method to fabricate all-solid-state thermally reduced Graphene Oxide (trGO) microsupercapacitors (μ-SCs) prepared using the atmospheric pressure chemical vapour deposition (AP-CVD) and a mask-free axidraw sketching apparatus. This is a quick, easily operational, cheap, safe, photoresist free, readily scalable method and requires no hazards reducing chemical. The XRD, FTIR and EDS suggest that increasing thermal reducing temperature increases the carbon content within the μ-SC active material. The electrochemical performance of the μ-SCs showed cyclic voltammetry (CV) potential window of 0 - 0.8V at various scan rates (5 – 1000 mVs-1) with a rectangular shape, depicting characteristics of electric double layer capacitor (EDLC) behaviour. The comb-style number of digits per unit area giving the highest capacitance was determined to be 14. The trGO-500 exhibits volumetric energy and power of 13.71 mW h cm-3 and 2677.31 W cm-3, respectively. The electrochemical impedance spectroscopy (EIS) showed the decrease in the equivalent series resistance (ESR) as a function of reducing temperature allotted to reduction of the resistive functional groups present in the sample. Bode plot showed a phase angel of -85 ° for the trGO-500 μ-SC device. The electrochemical performance of the μ-SC devices can be tailed by varying the reducing temperature, number of digits per unity area, and connection configuration (parallel or series).

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NO

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