Electronic Supplimentry Information

Facile room temperature methods for growing ultra thin films of graphene nanosheets, nanoparticulate tin oxide and preliminary assessment of graphene-tin oxide stacked layered composite structure for supercapacitor application.†

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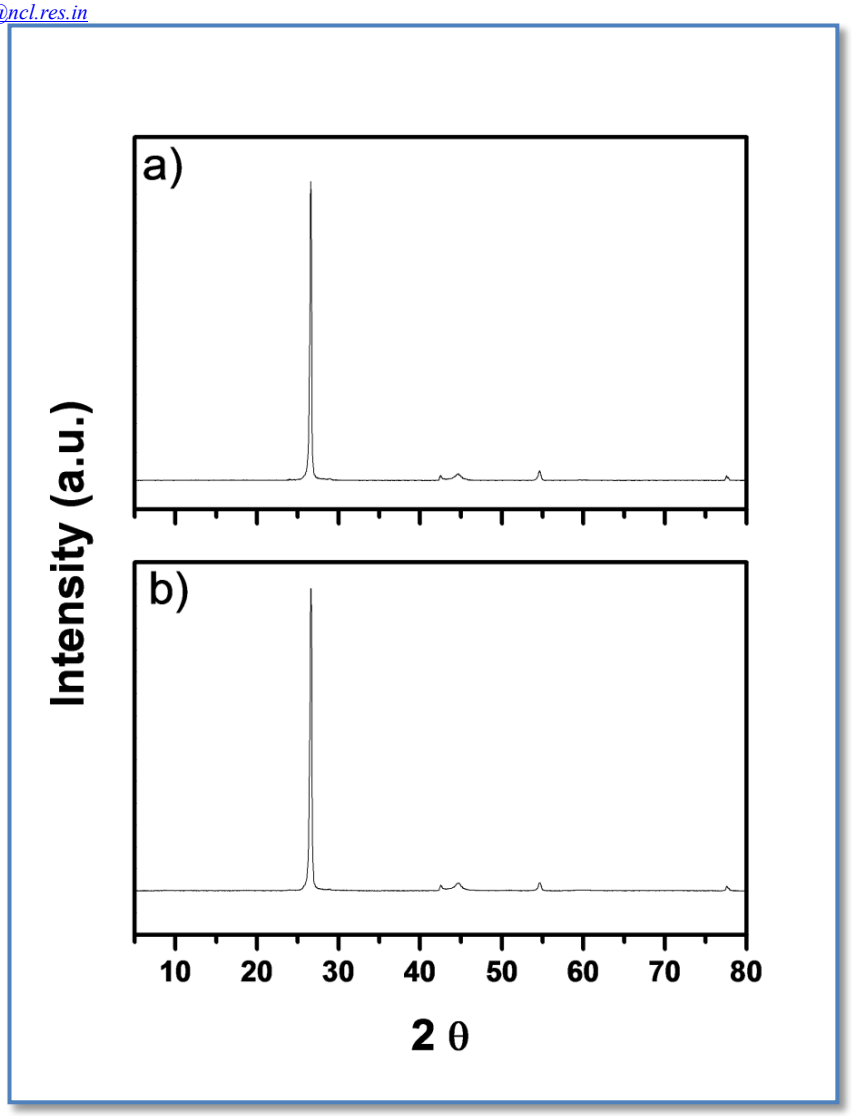

Fig. S1 XRD pattern of (a) natural flake graphite and (b) expandable graphite

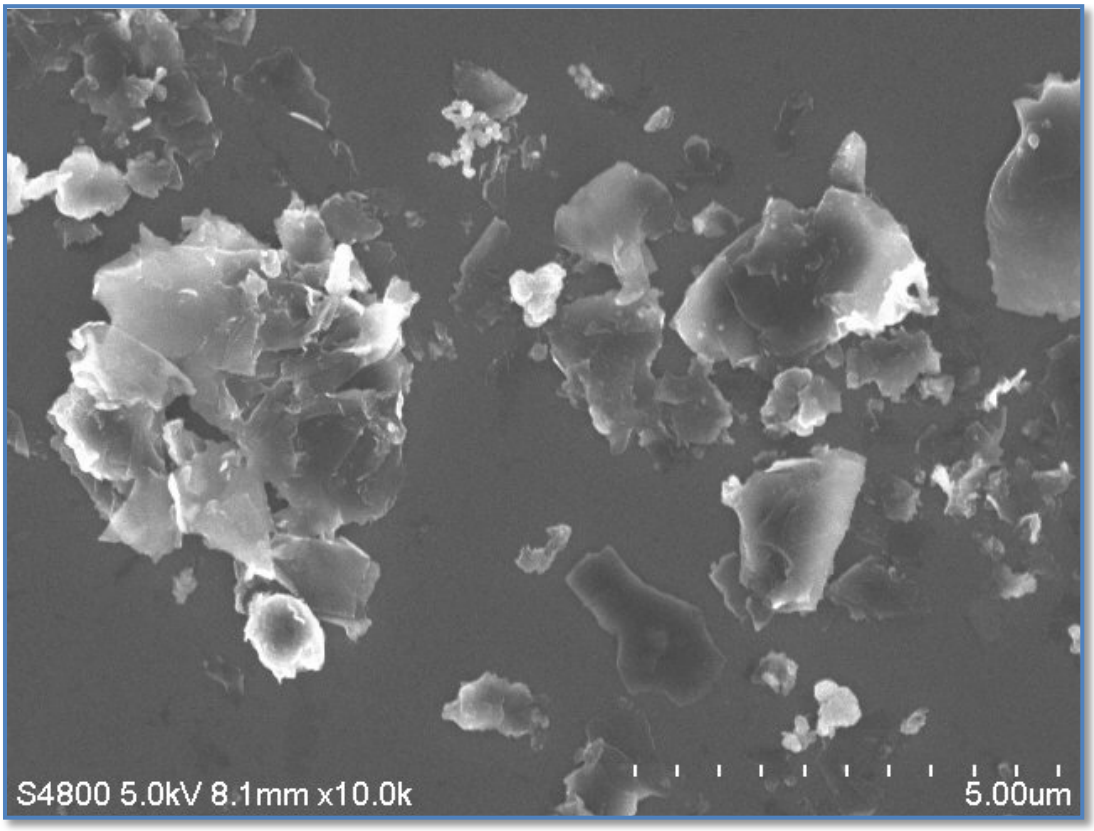

Fig. S2 The FESEM image of graphene sheet indicating the graphene sheets are continuous over micrometer scale area.

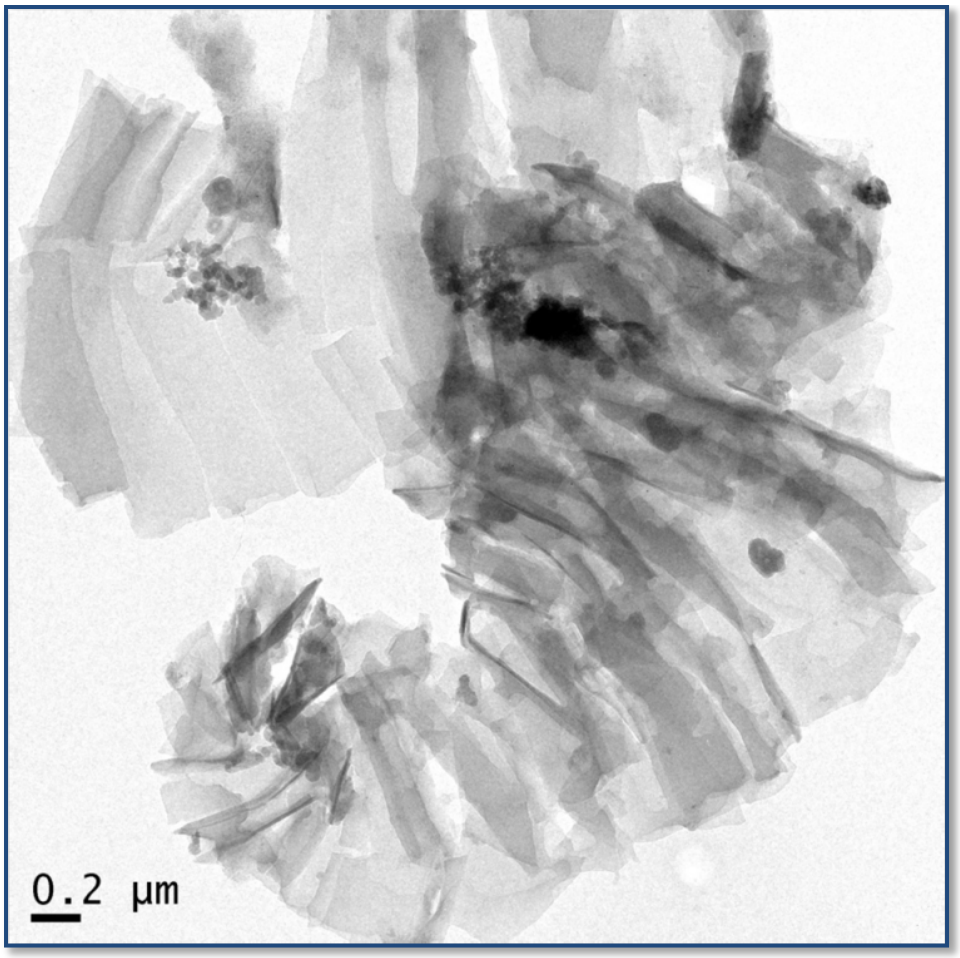

Fig. S3 The TEM image of graphene sheets with varying length

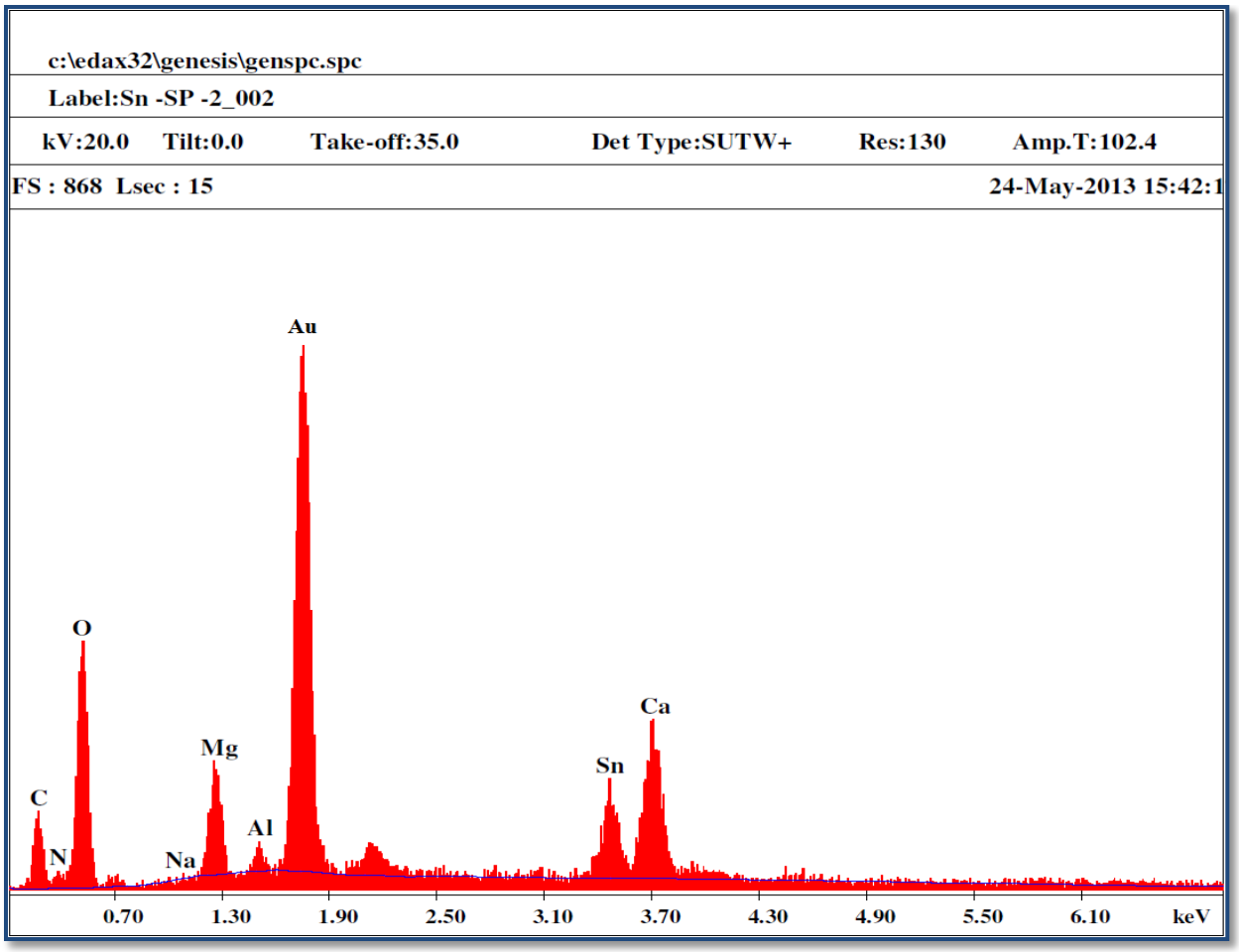

Fig. S4 EDX of SnO2 thin film over the glass substrate coated with gold.

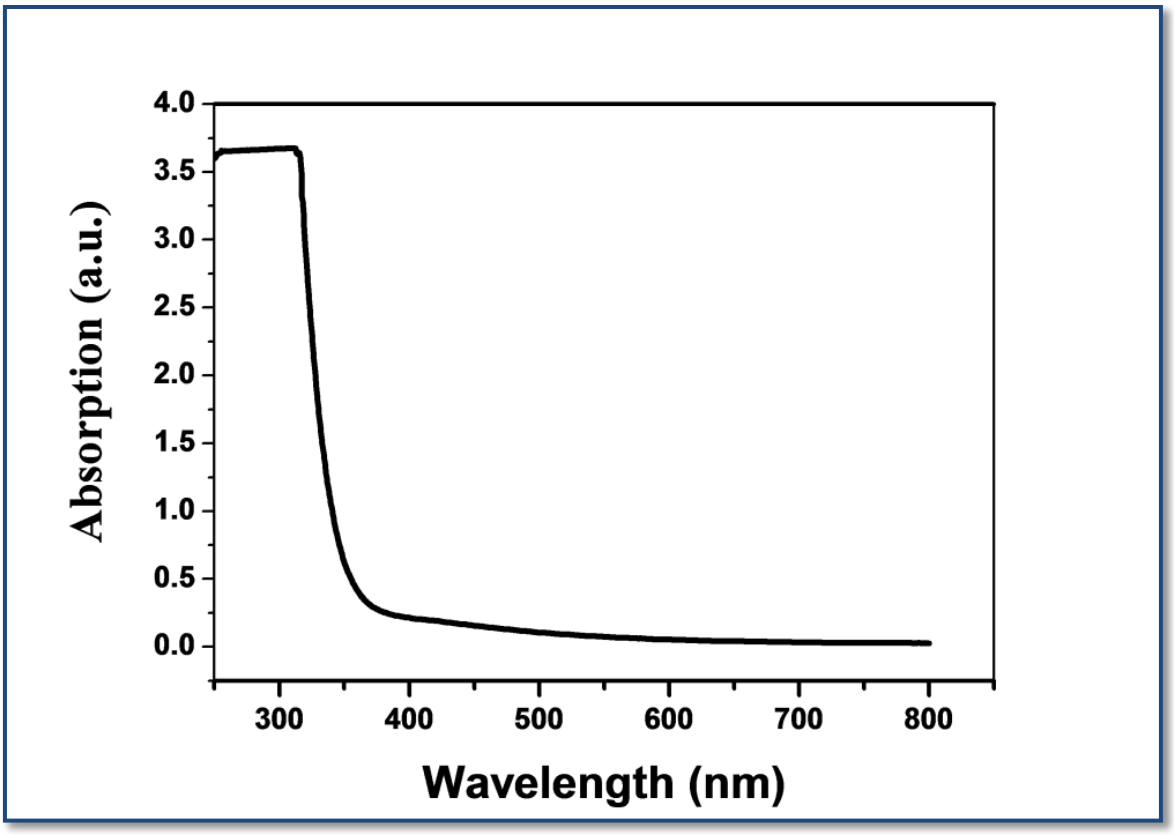

Fig.S5 UV-Vis. Spectra for pureSnO2 nanoparticulate thin film.

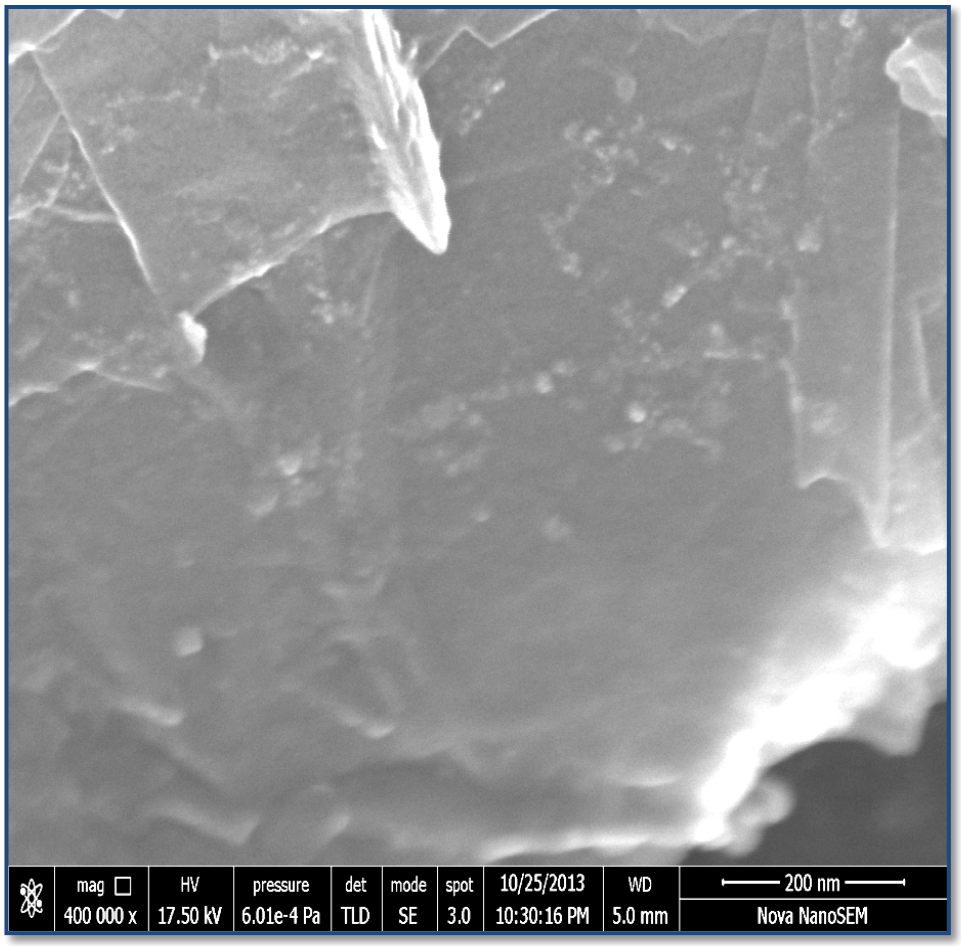

Fig. S6 FE-SEM of SnO_2/GNS composite, showing SnO2 nanoparticles on graphene nanosheets.

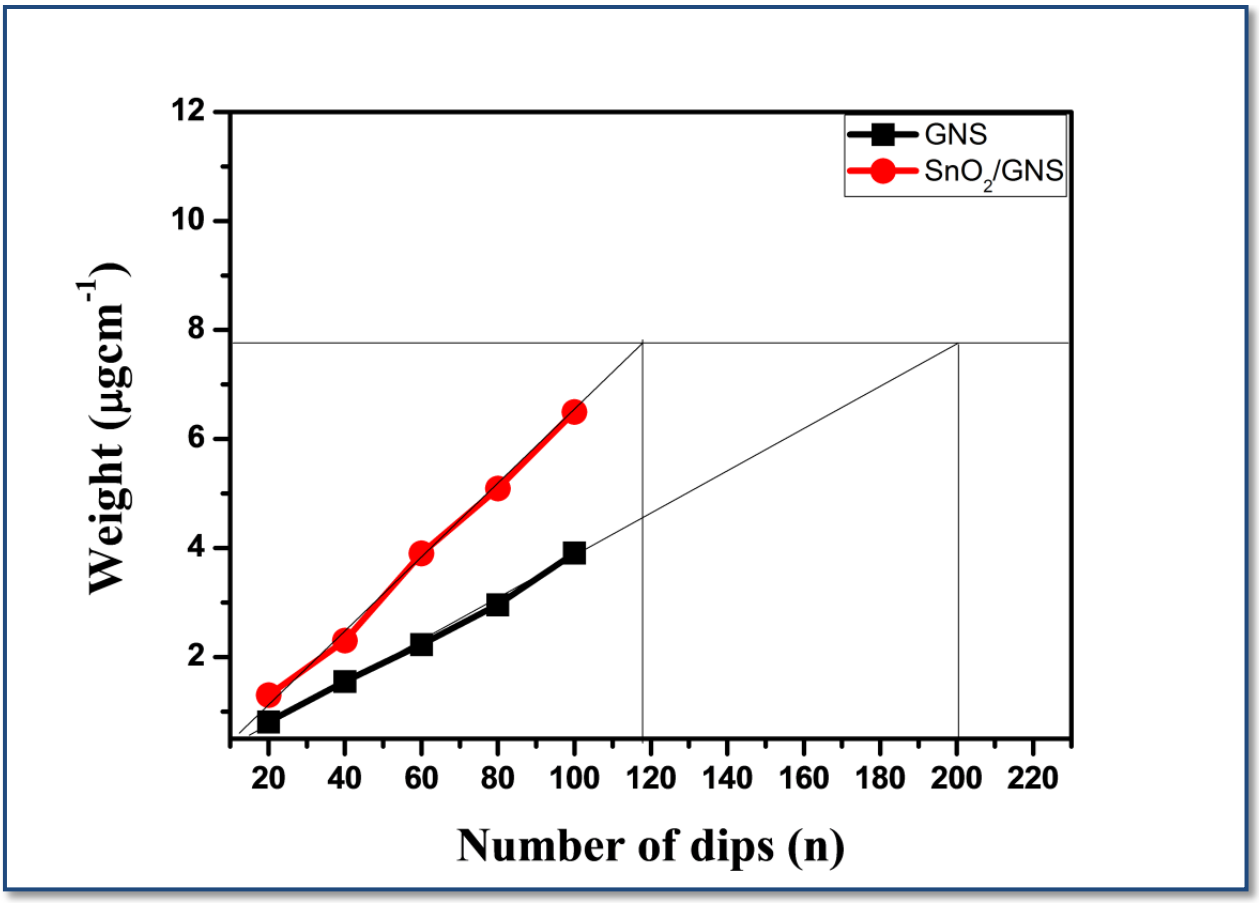

Fig. S7 Calibration plot for the measurement of active mass of the electrode (obtained by Quartz Crystal Microbalance) as a function of number of dips taken.

Detailed procedure for mass measurement:

The quartz crystal is first cleaned by using isopropyl alcohol (IPA), and then distilled water alternately followed by sonication in IPA for 10 minute, and finally washed by using distilled water. After drying crystal in vacuum oven for 30 min at 90^0C, it is placed in groove of machine (QCM-200) and blank run is taken. This crystal is then used to deposit GNS and SnO_2/GNS thin film over it and it is kept to dry in vacuum oven for the same time and temperature as for the blank; after drying, it is kept for measurement in the machine and the difference in frequency (Δ freq) is calculated.

The mass (m) is calculated by using Sauerbrey equation,[1]

$$m = \frac{-\Delta\, freq. \times A \times \sqrt{(\mu q \times \rho q)}}{2 \times Fq^2}$$

Where,

Δ mass is the mass change, Δ freq is the resonant frequency change (Hz), μ_q is AT-cut quartz crystal constant, ρ_q is the quartz crystal density, F_q is the reference frequency, and A is the surface area of the electrode (cm^2)

The calibration plot is obtained by measuring the mass of the material for number of dips taken as shown in Fig. S5. GNS electrode is made by taking 200 dips, and calculated mass is 7.8±0.05 µg and for SnO_2/GNS the same mass is used for ease of comparison and not any other reason.

Table S1

	Specific capacitance Fg^{-1} from Cyclic Voltametry.				Retention
Scan Rate	**50 mVs^{-1}**	**100 mVs^{-1}**	**150 mVs^{-1}**	**200 mVs^{-1}**	**(%)**
GNS	**122**	**93.84**	**88.2**	**86.15**	**70.61%**
GNS+SnO_2	**472**	**386**	**346**	**321**	**68.1%**

Above values are calculated from the equation-1, mass 'm' is 7.8±0.05 µg for both the electrodes.

Table S2

	Specific capacitance Fg^{-1} From Charge/Discharge.				Retention
Current	**10µA**	**20 µA**	**50 µA**	**100 µA**	**(%)**
GNS	**87.17**	**85.02**	**73.06**	**69.1**	**79.27%**
GNS+SnO_2	**471**	**352**	**299.48**	**233.97**	**49.57%**

Above values are calculated from the equation-2 in the main article, here mass 'm' is 7.8±0.05 µg for both the electrodes, thus **10µA/7.8µg** becomes **1.28 Ag^{-1}** and so on.

Reference:

1) T. Lee, T. Yun, B. Park, B. Sharma, H. K. Song and B-S. Kim, *J. Mater. Chem.*, 2012, **22**, 21092-21099.