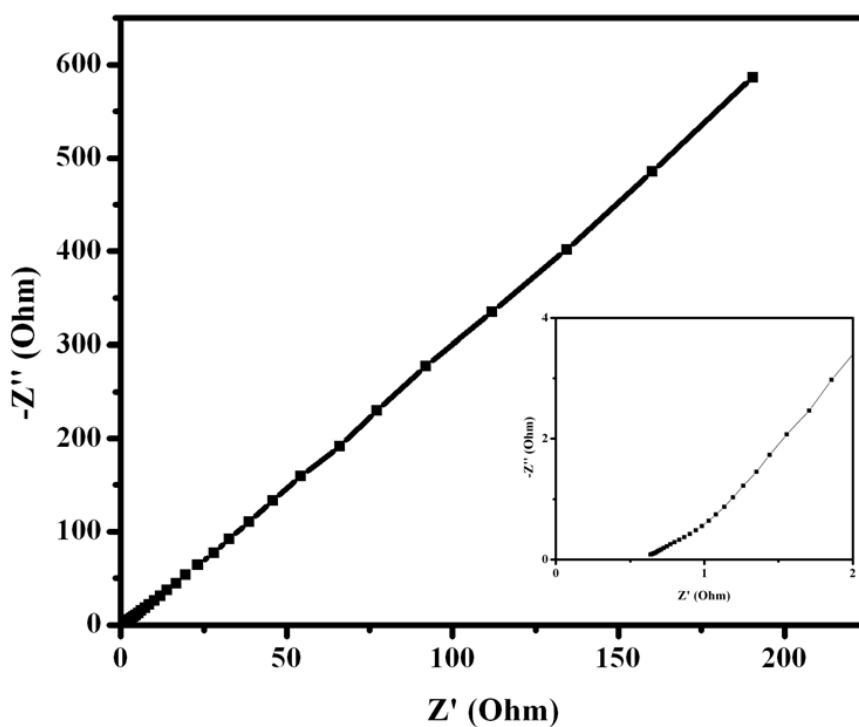


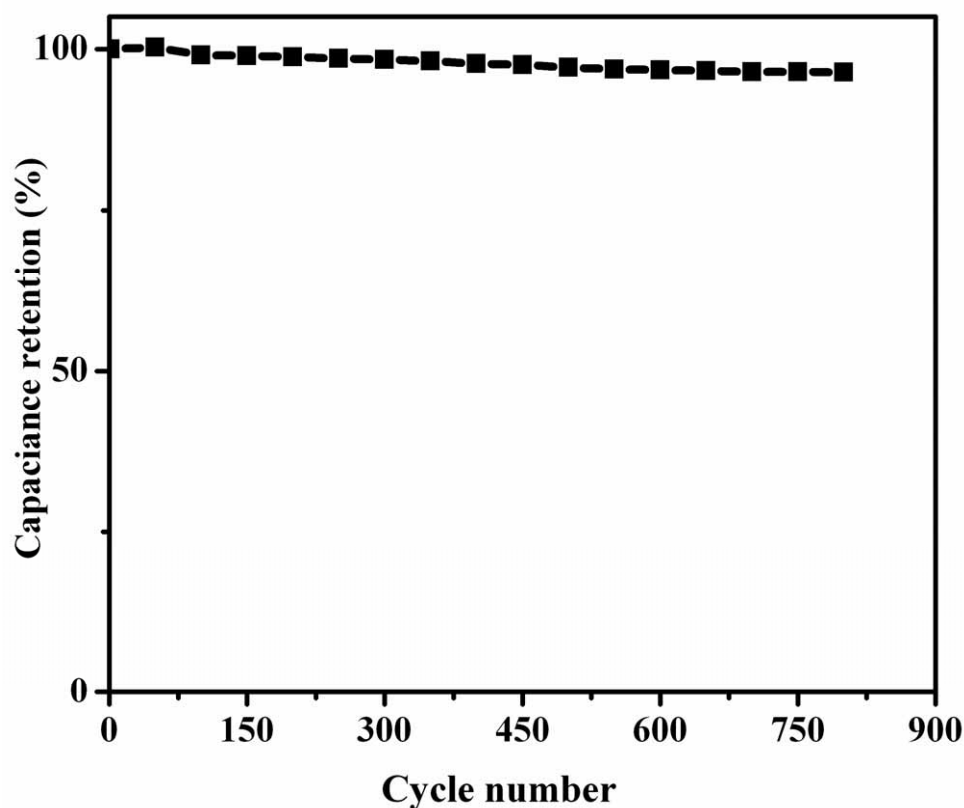
## Supplementary Information

# Hydrous RuO<sub>2</sub>-carbon nanofiber electrodes with high mass and electrode-specific capacitance for efficient energy storage

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**Fig. S1.** Impedance Nyquist plots obtained for CNF electrode in the range of 1 MHz to 0.01 Hz. Inset of the figure shows the high frequency region. The impedance spectrum of CNF shows the high resistance behaviours of the electrode and also straight line inclined at an angle of  $45^\circ$  to the real axis which represents the diffusion controlled electrode kinetics in the lower frequency region due to its porous structure.

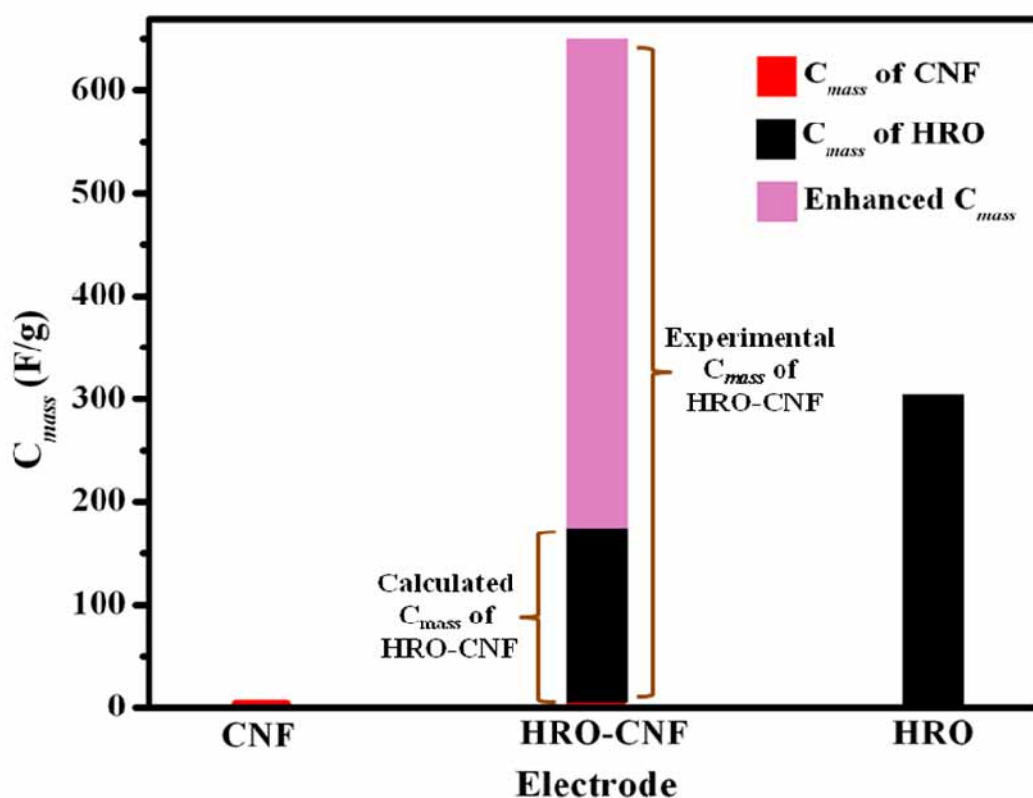


**Fig. S2.** Capacitance retention behavior of HRO-CNF electrode based supercapacitor obtained by carrying out the charge-discharge measurement at current density of  $8\text{mA}/\text{cm}^2$  in a two-electrode device.

#### Caluation of specific capacitance of HRO-CNF from CNF and HRO

The specific capacitance of the hybrid materials can be calculated from capacitance values of individual CNF and HRO according to their weight ratios in the composite by using a formula  $C_{\text{mass}}^{\text{Cal}} = C_{\text{mass}}^{\text{HRO}} \left\{ \frac{\text{Ru wt.}\%}{62.9\%} \right\} + C_{\text{mass}}^{\text{CNF}} \left\{ 1 - \frac{\text{Ru wt.}\%}{62.9\%} \right\}$ . Where  $C_M^{\text{HRO}}$  is the mass specific capacitance of HRO and  $C_M^{\text{HRO}}$  is mass specific capacitance of CNF. Here 62.9% is the weight ratio of Ru in HRO. Figure S2 shows the experimental and calculated mass specific capacitance values of the HRO-CNF. The enhanced capacitance obtained from the difference between the

experimental and calculated specific capacitance, which indicates the combined effects of CNF and HRO in the composites. The fine distribution of nearly 1.5 nm sized amorphous HRO on CNF surface is responsible for this large enhancement. This deposition created better electrode-electrolyte interface in composites for charge storage compared to that of pure agglomerated HRO. The anchoring effect from functional group from carbon surface also is helpful for better stability and fine distribution of HRO on the CNF surface. The impedance spectrum also supports the improved porous texture of the composite compared to pure HRO. Therefore, the characteristic nanoparticle-hollow tube structure provides maximum utilization of the deposited HRO effectively for charge storage.



**Figure S3.** Experimental and calculated mass specific capacitance values of the HRO-CNF electrode. The calculated capacitance is obtained from the sum of the mass specific capacitance of individual CNF and HRO components in the composite.