Supporting Information

Improved performance of electric double layer capacitor using redox additive (VO\textsuperscript{2+}/VO\textsuperscript{2+}) aqueous electrolyte

S. T. Senthilkumar,† R. Kalai Selvan,†* J. S. Melo,‡ Y. S. Lee,§ and N. Ponpandianξ

†Solid State Ionics and Energy Devices Laboratory, Department of Physics, Bharathiar University, Coimbatore- 641046, Tamil Nadu, India
‡Nuclear Agriculture and Biotechnology Division, Bhabha Atomic Research Centre, Trombay, Mumbai-400085, India
§Faculty of Applied Chemical Engineering, Chonnam National University, Gwangju 500-757, Korea
ξDepartment of Nanoscience and Technology, Bharathiar University, Coimbatore- 641046, Tamil Nadu, India

Gel polymer electrolyte used EDLC fabrication:

The PVA/VOSO\textsubscript{4}/H\textsubscript{2}SO\textsubscript{4} gel polymer was prepared using optimal VOSO\textsubscript{4} (0.3 g) added 1 M H\textsubscript{2}SO\textsubscript{4} electrolyte. In detail, 1 g of PVA was mixed with 20 ml of hot (70 °C) water with constant stirring for 2 h to form the clear solution. Afterwards, 10 ml of 0.3 g VOSO\textsubscript{4} added 1 M H\textsubscript{2}SO\textsubscript{4} was added to the above solution with constant stirring and it was kept up to formation of glue like gel solution. The PVA/VOSO\textsubscript{4}/H\textsubscript{2}SO\textsubscript{4} gel electrolyte EDLC was fabricated by the method reported elsewhere. The prepared gel electrolyte was coated on the surface of the electrodes. Then, gel electrolyte EDLC was assembled together the gel electrolyte coated electrodes by face-to-face.

Figure S1
Figure 2. FT-IR spectra of NaA-3

Figure S2

![Figure S2: EDAX spectra of NaA-3](image)

Figure 3. EDAX spectra of NaA-3

Figure S3

![Figure S3: Specific capacitance as function of current density.](image)

Figure S3. Specific capacitance as function of current density.
**Figure S4**

(a) Admittance plot; (b) Real capacitance as function of frequency.

**Figure S5**

(a, b) CV at 5-200 mV s\(^{-1}\) and charge-discharge curve at 1-20 mA cm\(^{-2}\) of 1 M H\(_2\)SO\(_4\) used EDLC; (c, d) CV at 5-200 mV s\(^{-1}\) and charge-discharge curve at 1-20 mA cm\(^{-2}\) of 0.3 g VOSO\(_4\)+1 M H\(_2\)SO\(_4\) used EDLC; (e) Energy efficiency as a function of current density.
Figure S6

![Graph showing energy efficiency vs. current density for polymer gel electrolyte EDLC.]

Figure 6. Energy efficiency Vs. current density of polymer gel electrolyte used EDLC

Figure S7

![Image of a fabricated EDLC device.]

Figure 7. Fabricated EDLC using gel polymer electrolyte (PVA/VOSO_4/H_2SO_4) with on testing mode.