High-performance quasi-solid-state asymmetric supercapacitor based on $BiMn_2O_5$ nanoparticles and redox-additive electrolyte

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The all solid-state supercapacitor devices were fabricated to check the practical application of the prepared electrode material. The charge balance of the quasi-solid-state asymmetric supercapacitor is maintained using the relationship of $q^+ = q^-$, where q^+ and q^- are the charges stored at the positive and negative electrodes, respectively. The charges stored by each electrode material depend on the specific capacitance (C_s), potential window (ΔV) and the mass of the active material (*m*), as given by equations:

$$q = C_s \times \Delta V \times m \qquad (S1)$$

So, the balance between the charges on positive and negative electrodes can be represented by:

$$C_s^+ \times \Delta V^+ \times m^+ = C_s^- \times \Delta V^- \times m^- \qquad (S2)$$

$$\frac{m^+}{m^-} = \frac{C_s^- \times \Delta V^-}{C_s^+ \times \Delta V^+}$$

$(S3)$

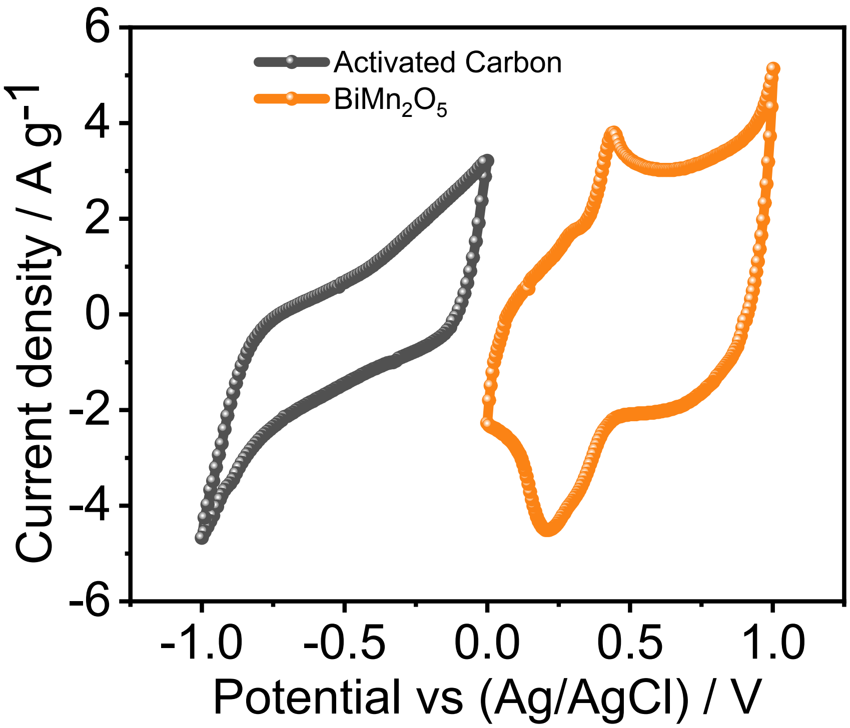

Fig. S1 CV curves of activated carbon and $BiMn_2O_5$ at 10 mV s^{-1} in negative and positive directions, respectively.

For mass balancing process, C_s values were calculated from the CV curve at 10 mV s^{-1} for positive and negative electrodes, and found to be 481 and 398 F g^{-1}, respectively. Potential windows for positive and negative electrodes were selected to be 0.0 to 1.0 V and –1.0 to 0.0 V, respectively, as shown in **Fig. S1**. So, the ΔV was equivalent to 2.0 V for the two electrode system. Hence, the mass ratio of positive to negative electrodes for device was decided to be 0.82.