Electronic Supplementary Material (ESI) for RSC Advances.

Supporting Information

Asymmetric Faradaic Assembly of Bi_2O_3 and MnO_2 for High Performance Hybrid Electrochemical Energy Storage Device

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S1: Specific Capacity calculation for electrode and device, and Energy Density and Power Density calculation for device

Specific Capacity from GCD curve is calculated using following relation in terms of C g^{-1};

$$Q = \frac{I\, t_d}{m_e} \tag{1}$$

Where, t_d is the discharge duration in GCD curve and m_e is the mass of active material loaded on the electrode or the total mass of the active material loaded on the device's positrode and negatrode. Further, for the case of non-linear GCD curves the discharged Energy Density from the device can be calculated by integrating the area under the discharged curve expressed as;

$$E_d = I \int_{t(V_{max})}^{t(V_{min})} V\,(t)\, dt \tag{2}$$

Where E_d is the discharge Energy Density, I is the discharge current and t (V_{min}) and t (V_{max}) is the limit of discharge time at highest and lowest voltage. Therefore, the corresponding Energy Density in terms of W h kg^{-1} can be given as follows;

$$E_s = \frac{E_d}{3.6\, m_t} \tag{3}$$

Where, E_s is the Energy Density and m_t is the total mass loaded on device's electrodes. Finally the Power Density in terms of W kg^{-1} can be given as;

$$P_s = \frac{E_s}{t(V_{min}) - t(V_{max})} * 3600 \tag{4}$$

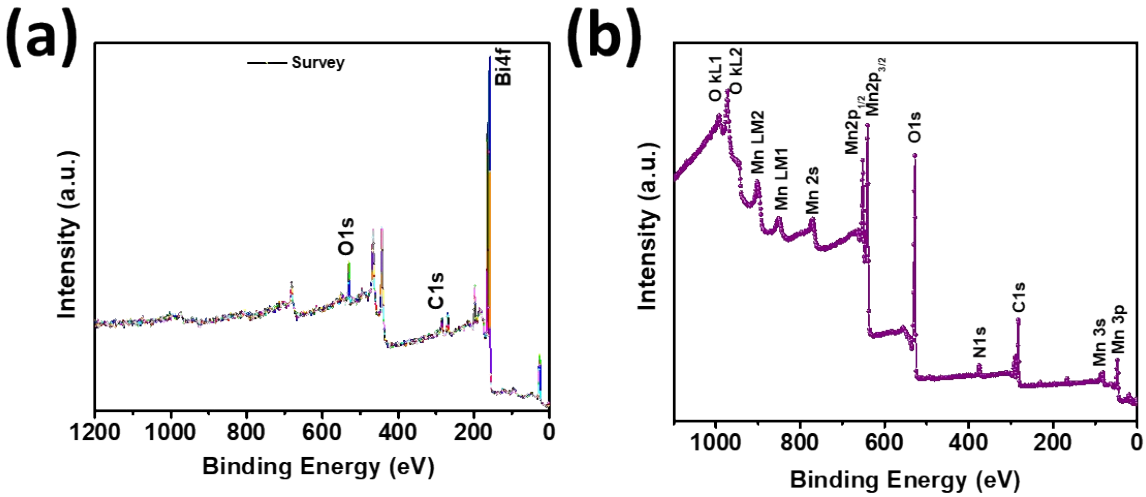

Fig. S1. Full Scan XPS spectra of (a) Bi_2O_3 and (b) MnO_2 nanostructures.

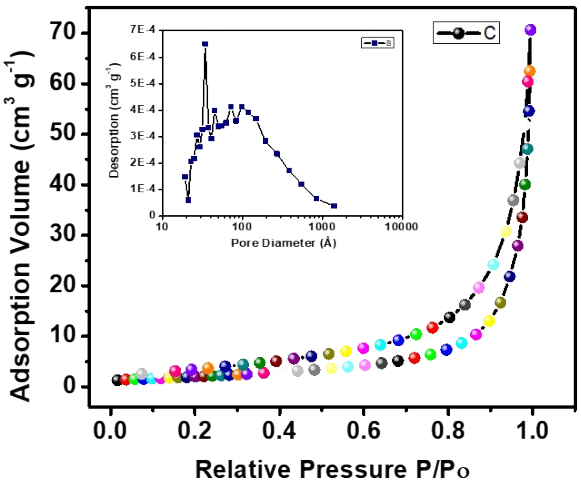

Fig. S2. BET isotherm curve of Bi_2O_3 nanostructure with the inset of BJH pore size distribution.

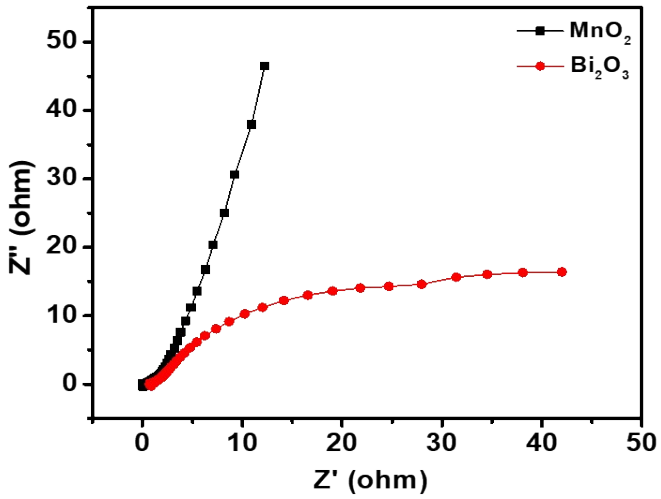

Fig. S3. Nyquist plot for Bi_2O_3 and MnO_2 electrode materials.

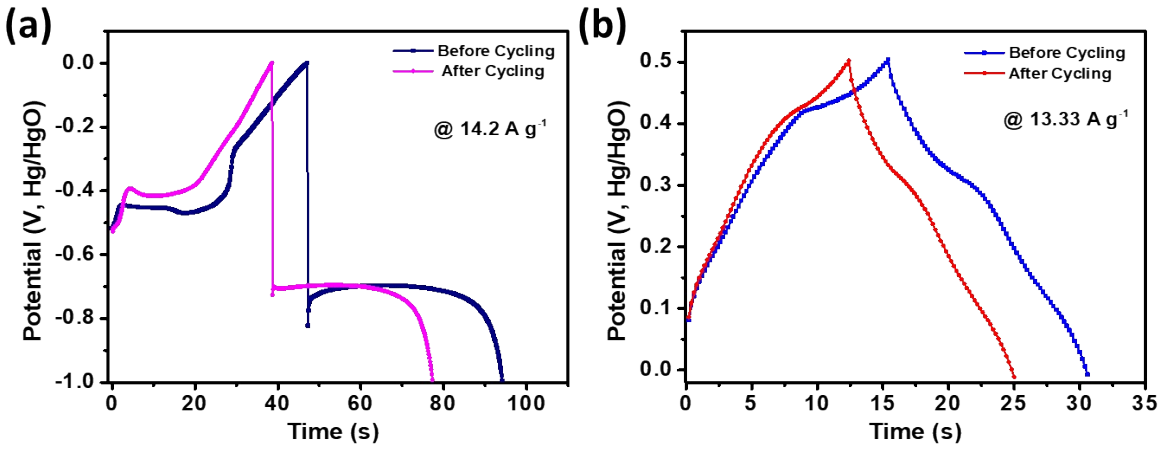

Fig. S4. GCD plots for (a) Bi_2O_3 electrode and (b) MnO_2 electrode materials before and after 4000-cylce.

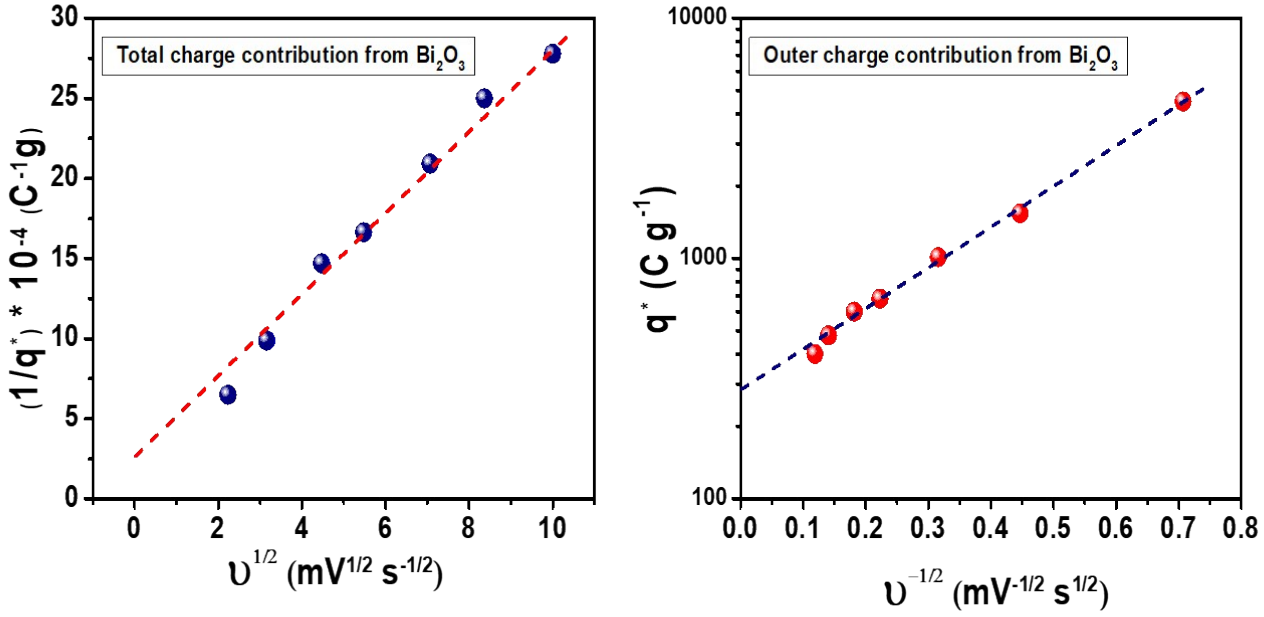

Fig. S5. Total and outer charge contribution plots for Bi_2O_3 electrode.

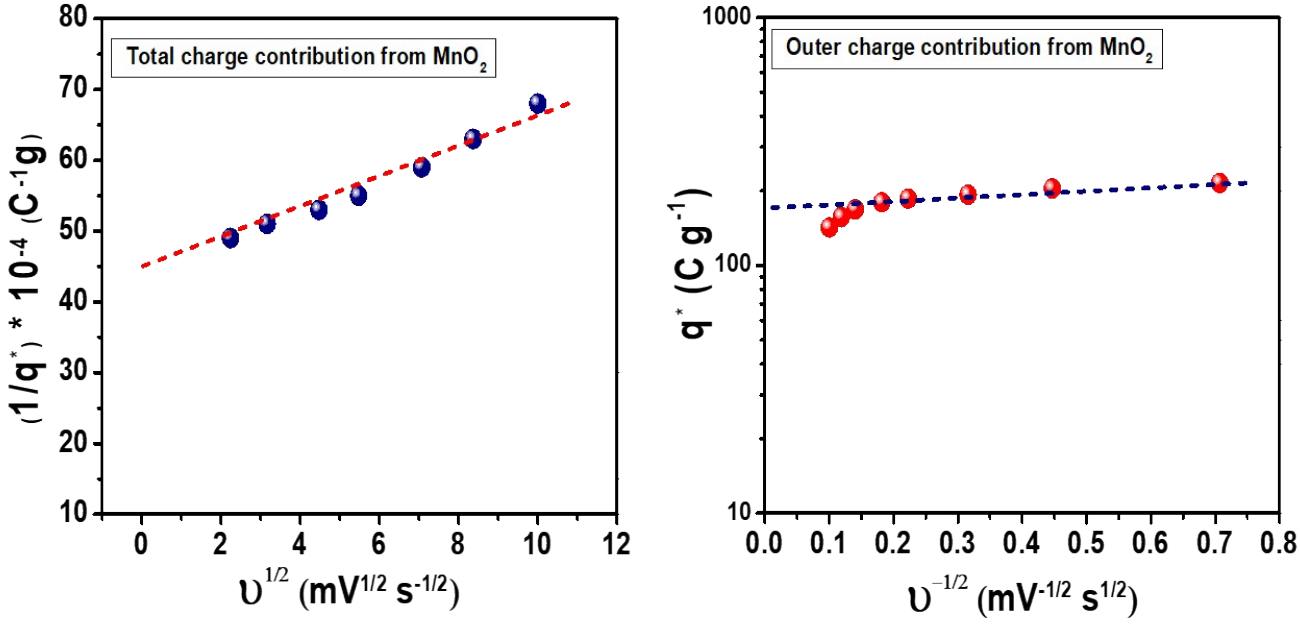

Fig. S6. Total and outer charge contribution plots for MnO_2 electrode.

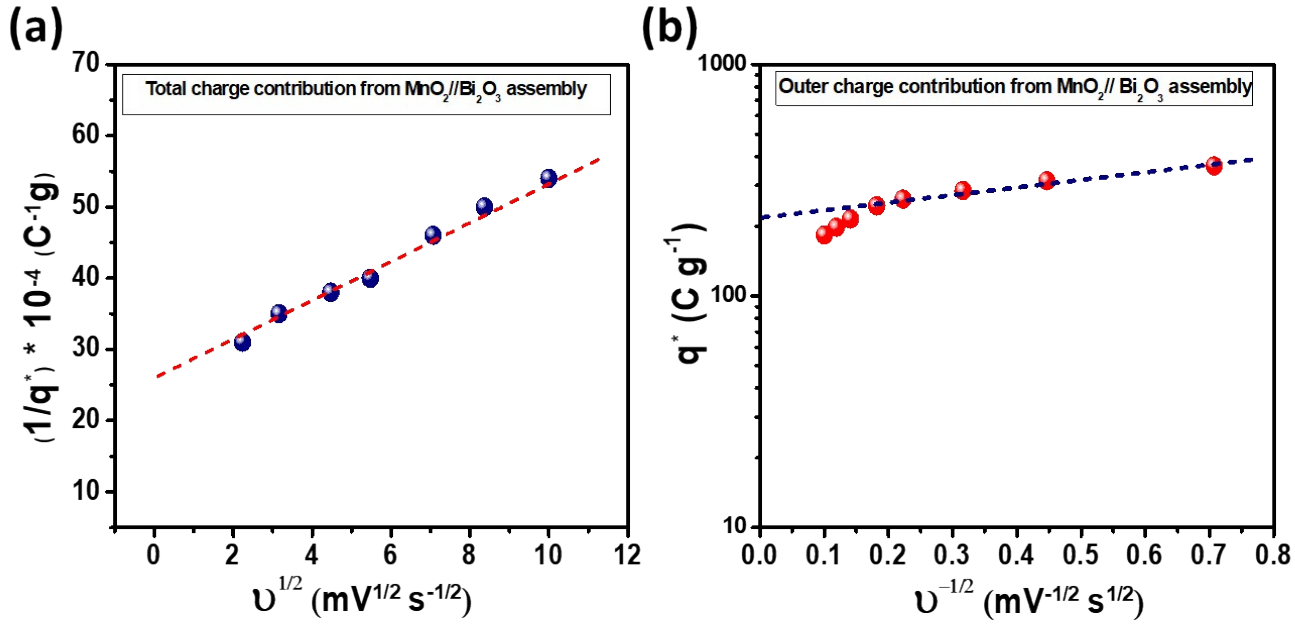

Fig. S7. Total (a) and outer (b) charge contribution plots for MnO_2 // Bi_2O_3 HEESD.

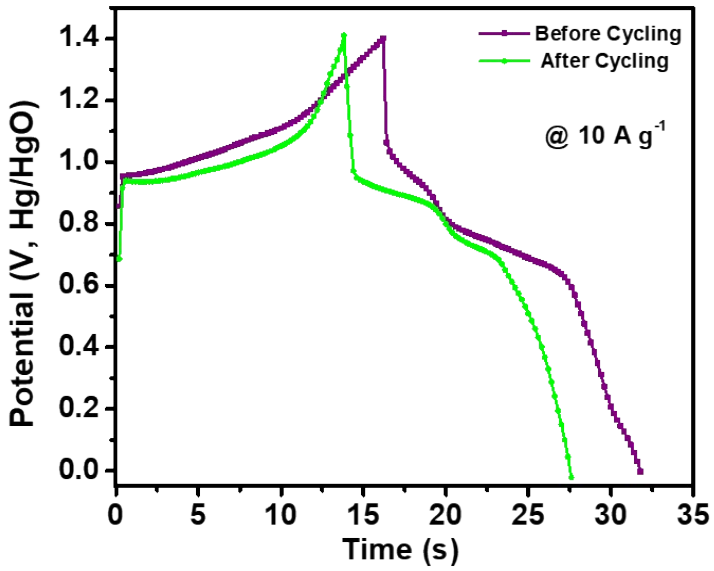

Fig. S8. GCD plot for MnO_2 // Bi_2O_3 HEESD before and after 5000-cycle.