Supporting Information

Comparison of Perovskite and Perovskite Derivatives for use in Anion-based Pseudocapacitor Applications

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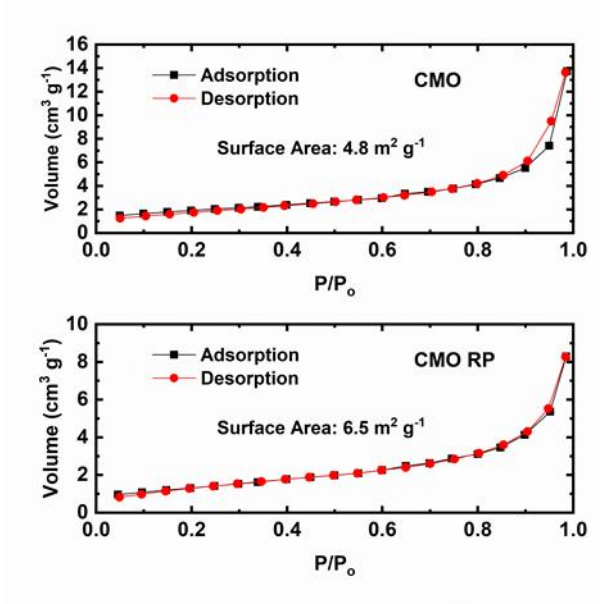

Figure S1. Nitrogen sorption isotherms for BET surface area analysis of unreduced $CaMnO_{3-\delta}$ (CMO) perovskite and $Ca_2MnO_{4-\delta}$ (CMO RP) Ruddlesden-Popper oxides.

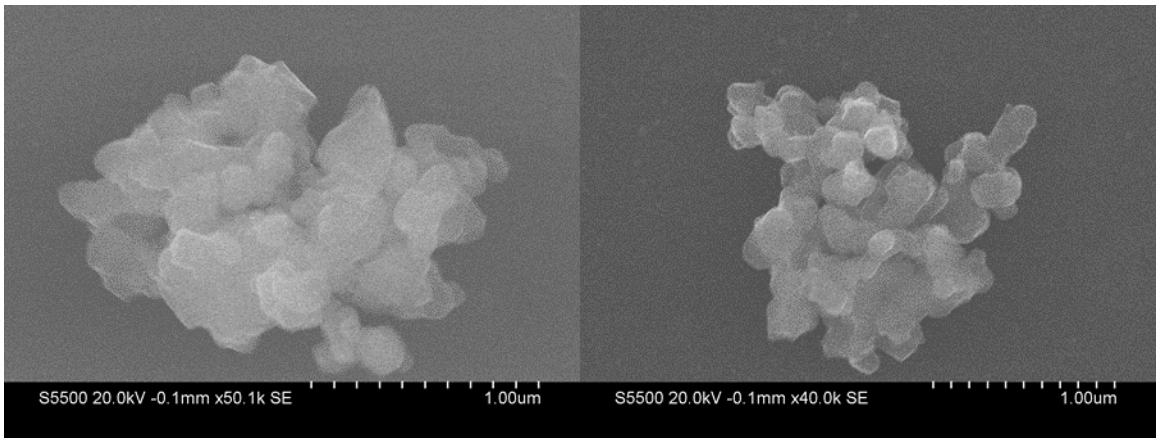

Figure S2. Additional SEM images of $CaMnO_{3-\delta}$ (CMO) perovskite oxide.

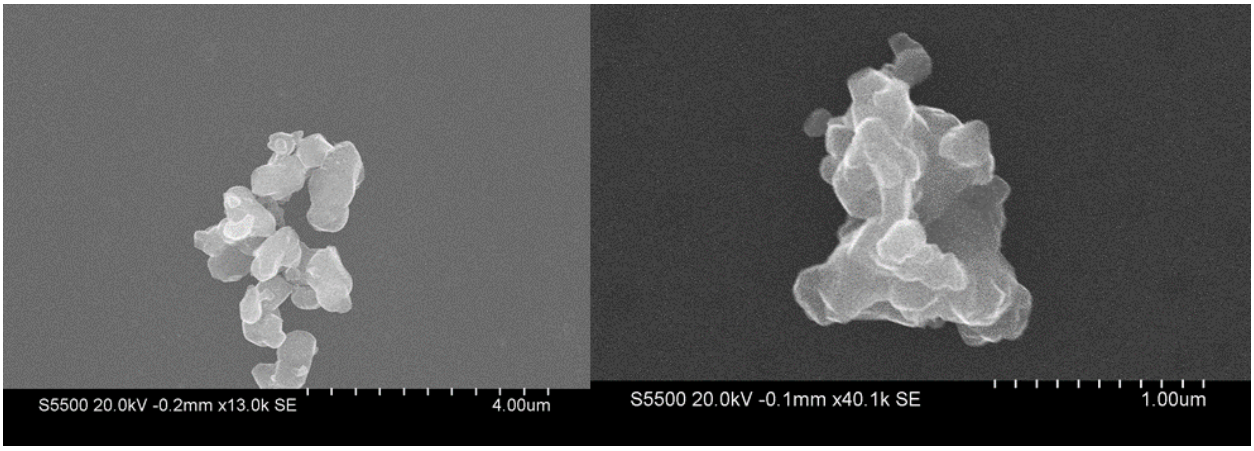

Figure S3. Additional SEM images of $Ca_2MnO_{4-\delta}$ (CMO RP) Ruddlesden-Popper oxide.

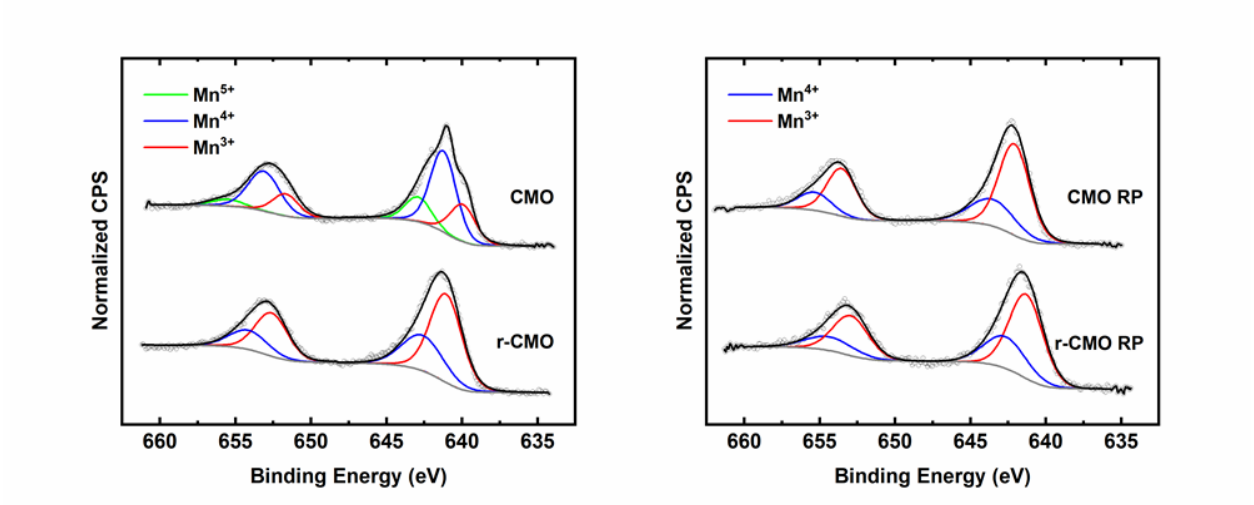

Figure S4. Mn 3p XPS analysis of $CaMnO_{3-\delta}$ (CMO) perovskite and $Ca_2MnO_{4-\delta}$ (CMO RP) Ruddlesden-Popper oxides before and after reduction in a reducing atmosphere of 7% H_2 in Ar at 325° C.

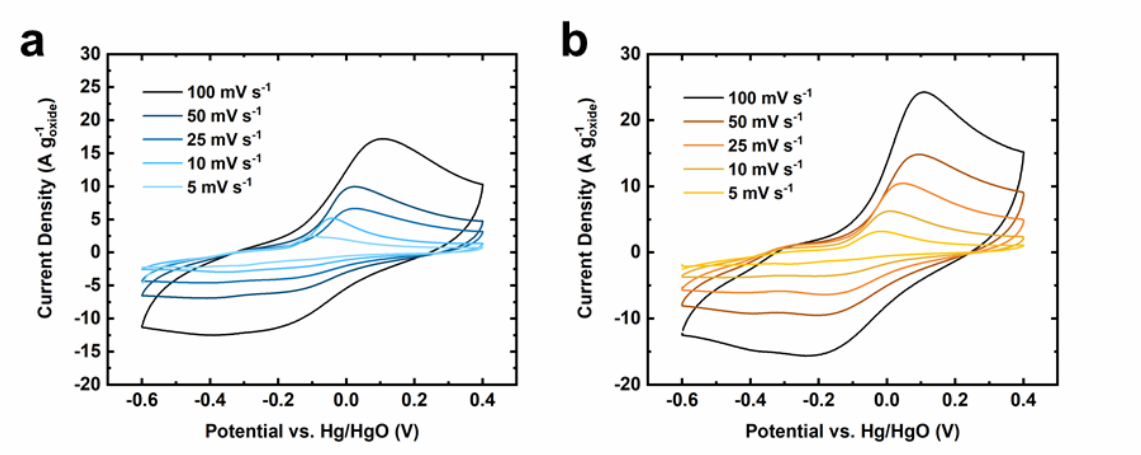

Figure S5. Electrochemical characterization of unreduced $CaMnO_{3-\delta}$ and $Ca_2MnO_{4-\delta}$ materials as pseudocapacitors in a 3-electrode cell. (a) CVs of CMO performed at multiple scan rates over a 1 V window. (b) CVs of CMO RP performed at multiple scan rates over a 1 V window.

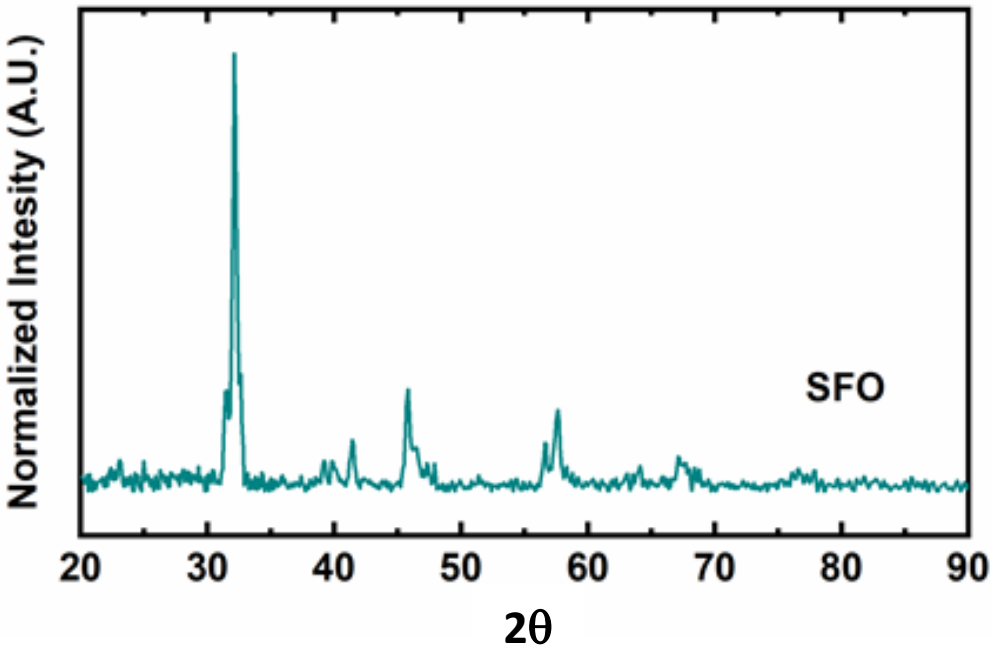

Figure S6. PXRD pattern of $SrFeO_{2.5}$ (SFO). Reduction of $SrFeO_3$ perovskite was performed in an atmosphere of 7% H_2/Ar at 325°C to achieve the Brownmillerite phase.

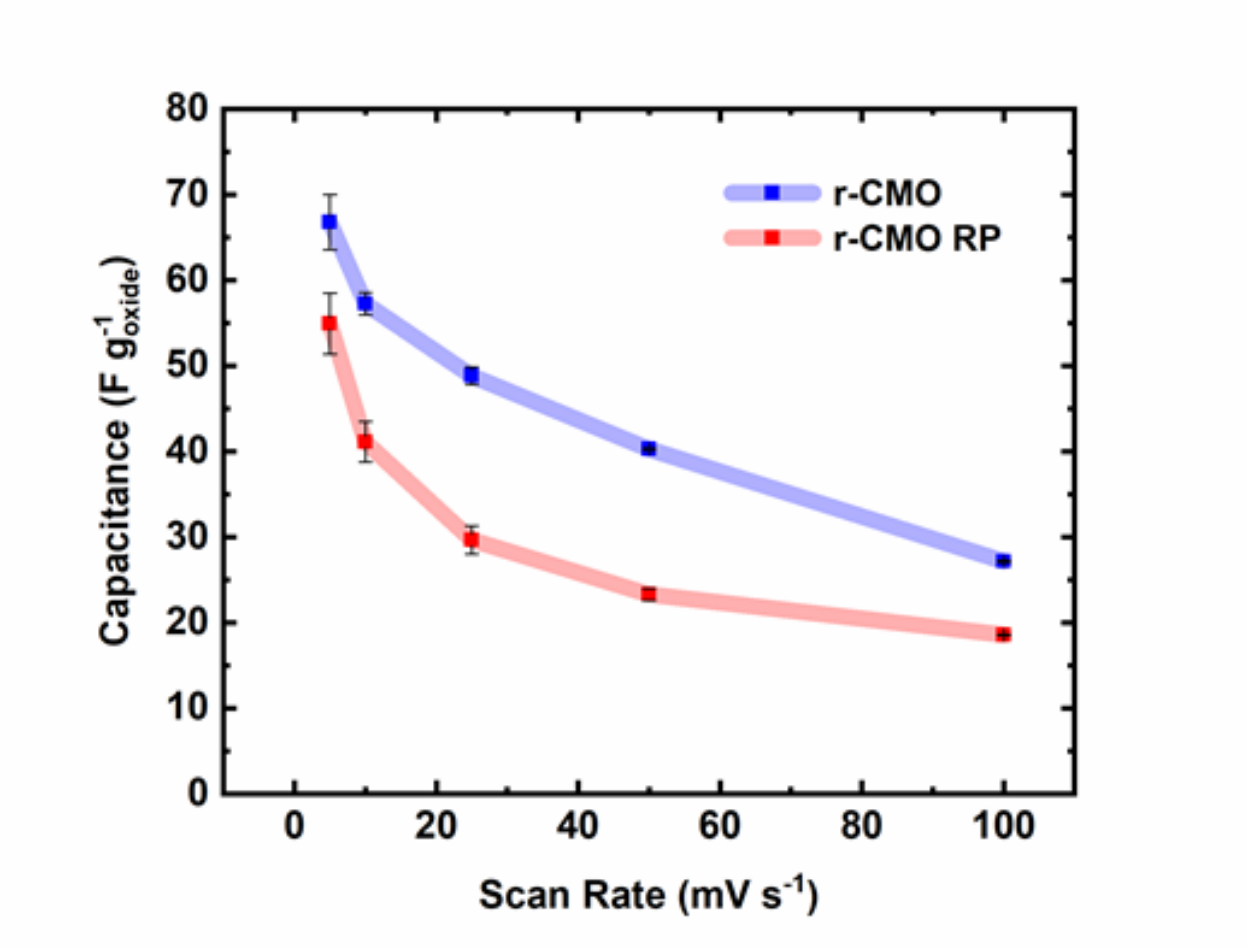

Figure S7. Gravimetric capacitances determined from CVs at various scan rates using $SrFeO_{2.5}$ as the anode material and either r-CMO or r-CMO RP as the cathode material in two-electrode cell asymmetric pseudocapacitor experiments.

Table S1. Electrochemically measured oxygen diffusion rates in $CaMnO_{3-\delta}$ (CMO) perovskite and $Ca_2MnO_{4-\delta}$ (CMO RP) Ruddlesden-Popper oxides.

Sample	Composition	Intercalation Oxygen Diffusion Rate ($cm^2\ s^{-1}$)	Deintercalation Oxygen Diffusion Rate ($cm^2\ s^{-1}$)
CMO	$CaMnO_{3.11}$	1.88E-11 ± 5.7E-12	2.44E-11 ± 3.6E-12
r-CMO	$CaMnO_{2.53}$	2.64E-11 ± 2.8E-12	3.71E-11 ± 1.2E-12
CMO RP	$Ca_2MnO_{3.92}$	3.54E-12 ± 1.4E-12	1.68E-12 ± 3.6E-13
r-CMO RP	$Ca_2MnO_{3.61}$	1.60E-11 ± 8.6E-14	1.44E-11 ± 4.9E-14