Supplementary Material for

Sr-doped $SmMnO_3$ Perovskites for High-performance Near-isothermal Solar Thermochemical CO_2-Fuel Conversion

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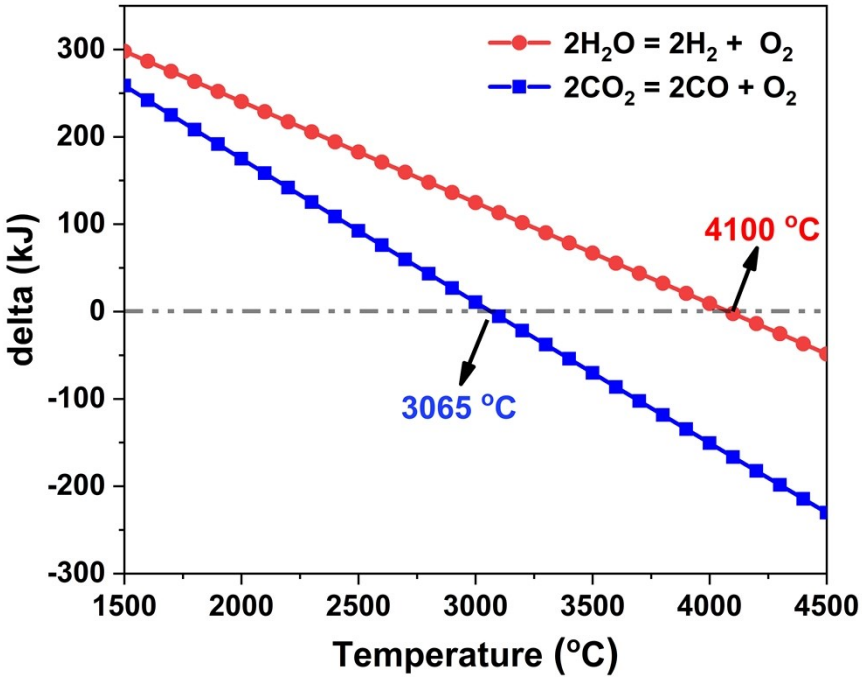

Fig. S1 Thermodynamics for CO_2 splitting ang H_2O splitting.

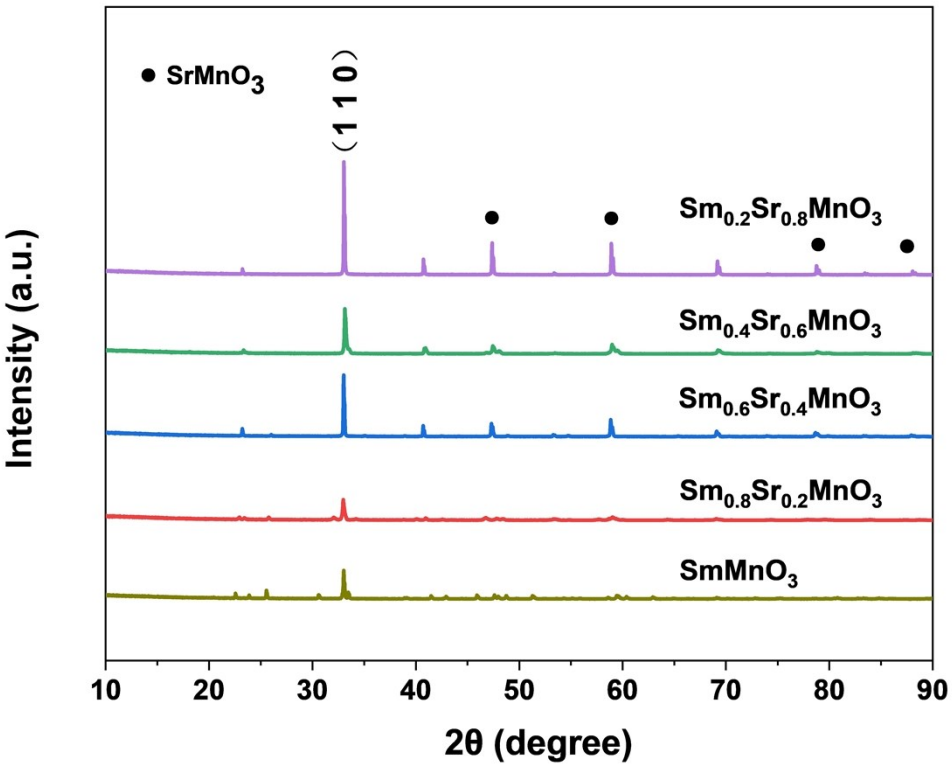

Fig. S2 X-ray diffraction patterns of the cycled Sr-doped $SmMnO_3$.

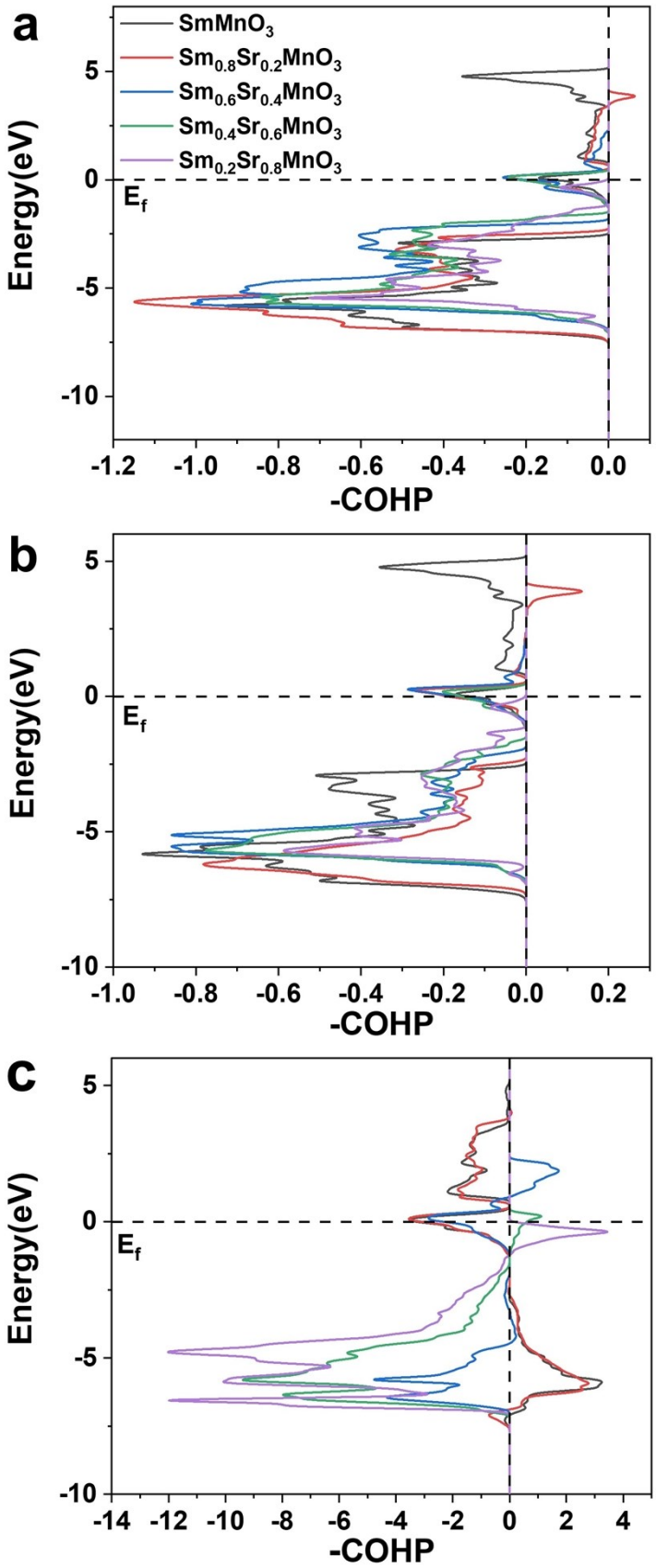

Fig. S3 DFT calculation of bond strength of (a) Sm-O, (b) Sr-O, and (c) Mn-O.

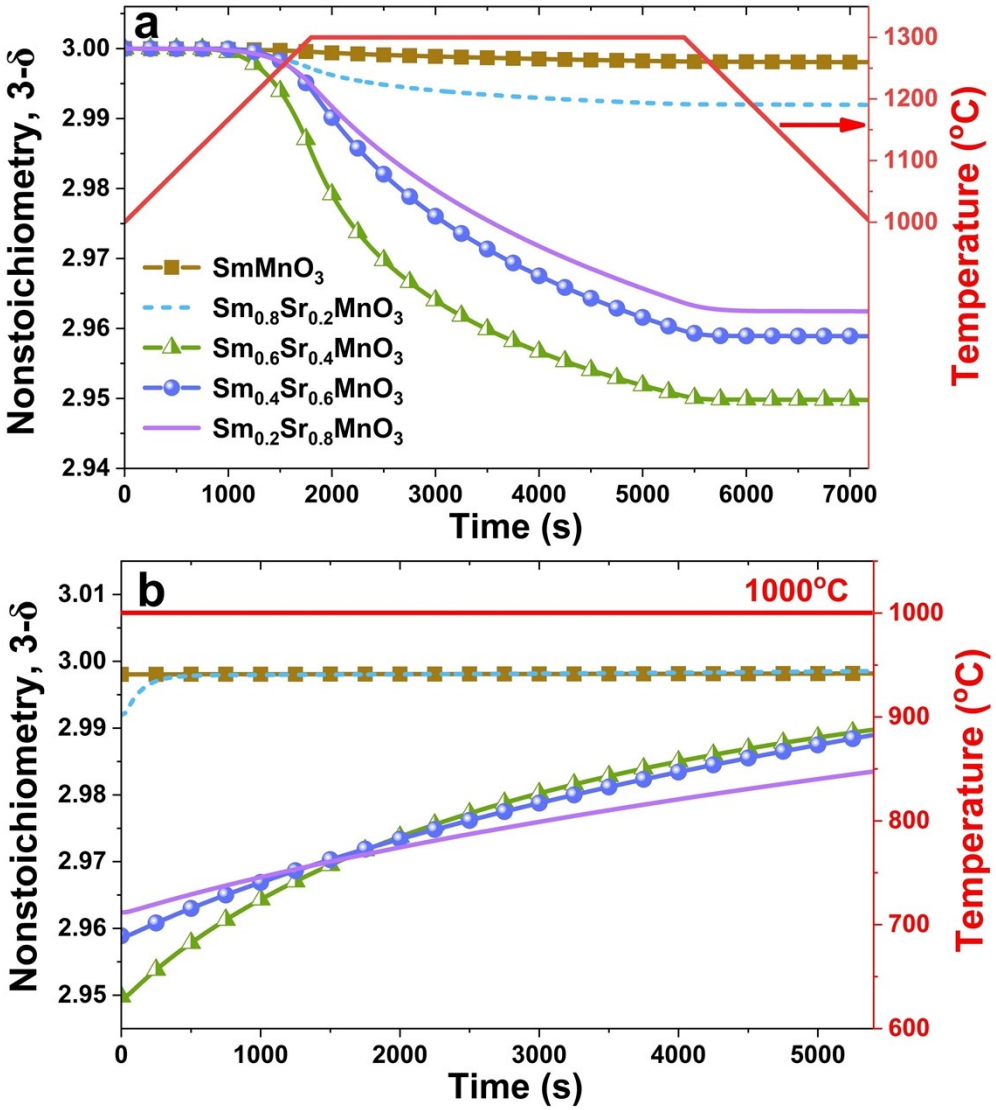

Fig. S4 Temporal evolution of non-stoichiometric oxygen over time during (a) reduction and (b) oxidation processes in the 2nd redox 1300 °C /1000 °C cycle.

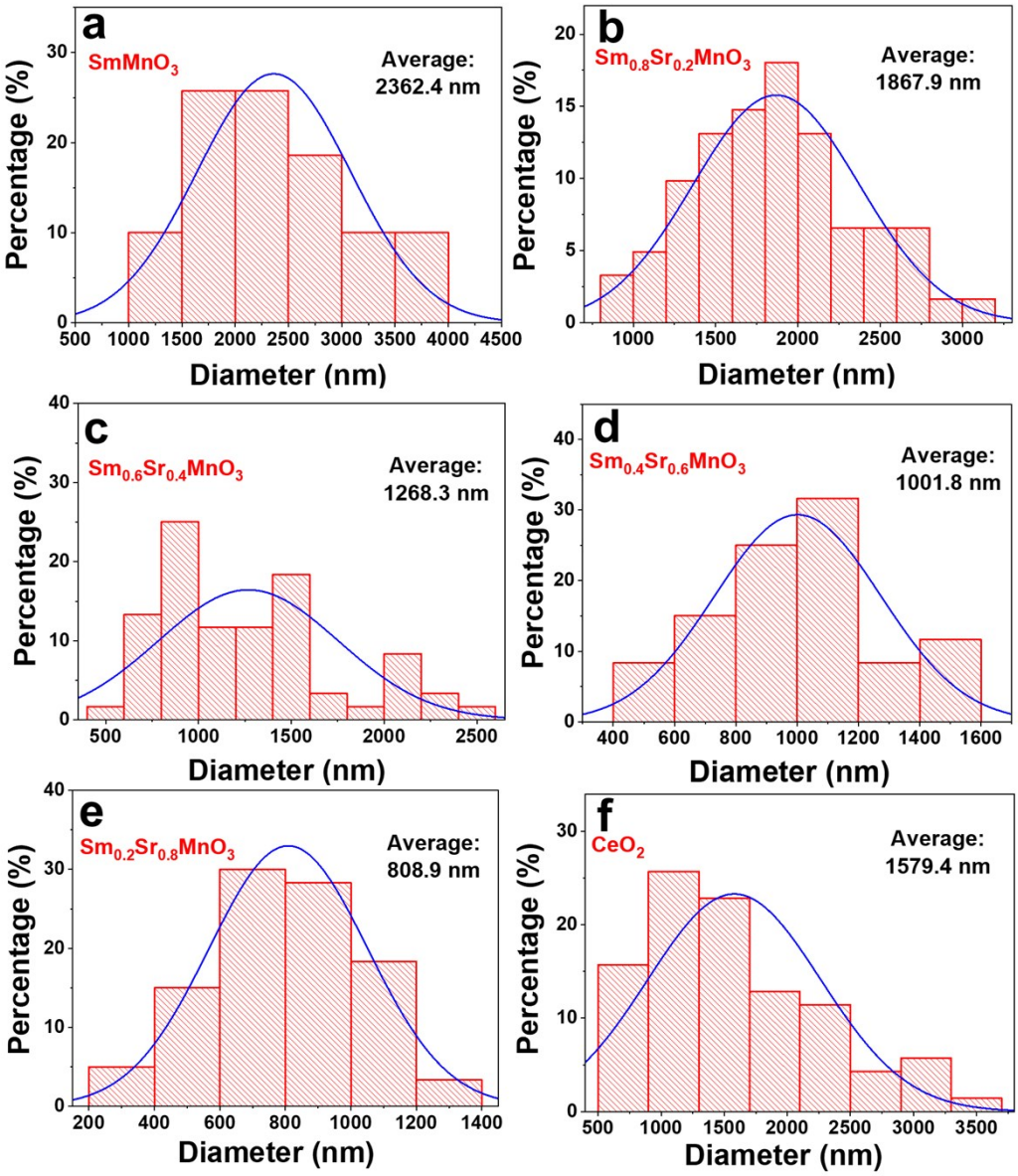

Fig. S5 Particle size distribution of as-synthesized Sr-doped $SmMnO_3$ and CeO_2 at 1300 ^oC/ 1000 ^oC redox cycle.

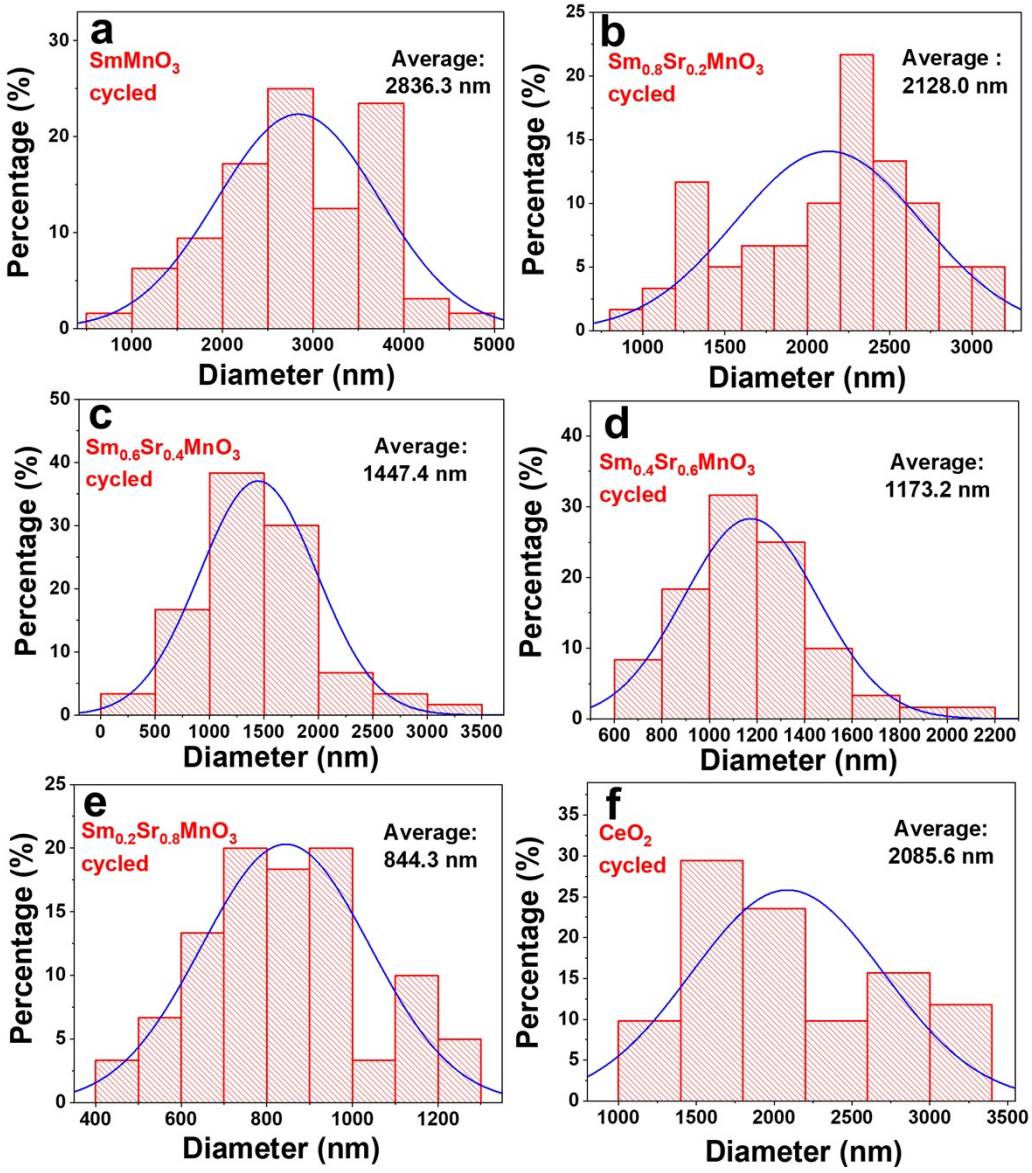

Fig. S6 Particle size distribution of cycled Sr-doped $SmMnO_3$ and CeO_2 at 1300 ^oC/ 1000 ^oC redox cycle.

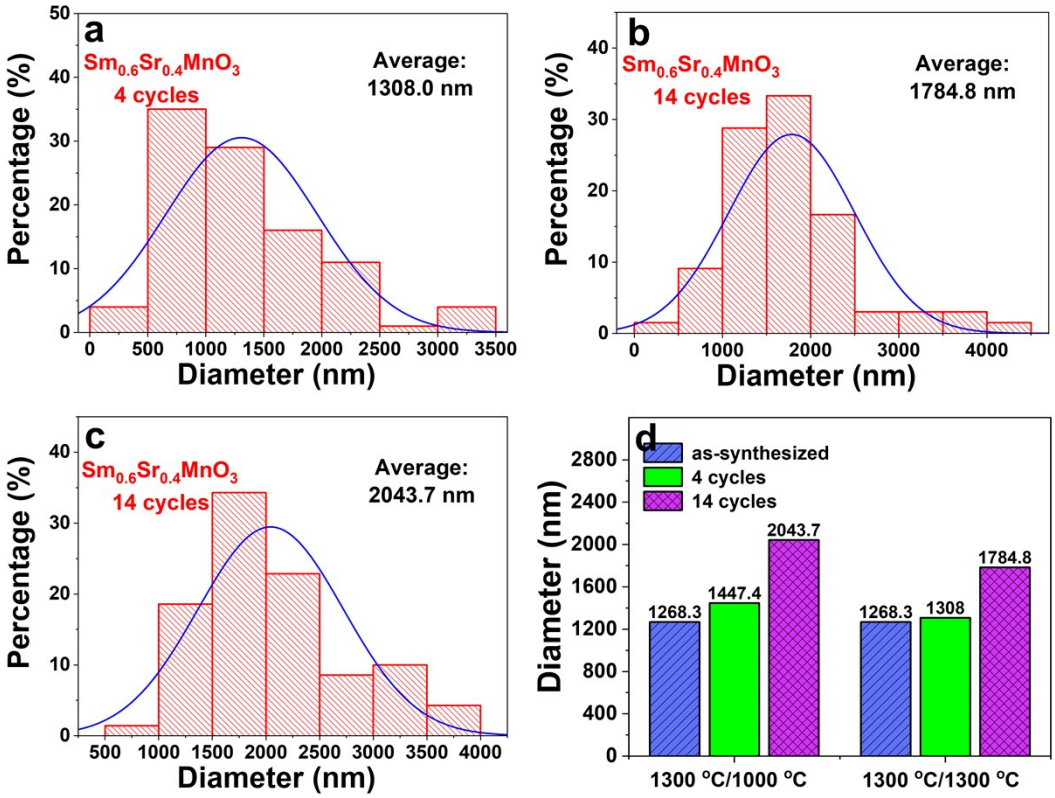

Fig. S7 Particle size distribution of Sm0.6Sr0.4MnO_3 after a) 4 cycles and b) 14 cycles at 1300 °C/ 1300 °C and c) after 14 cycles at 1300 °C/ 1000 °C. d) The change of particle size for Sm0.6Sr0.4MnO_3 after 0, 4, and 14 cycles at 1300 °C/ 1000 °C and 1300 °C/ 1300 °C.

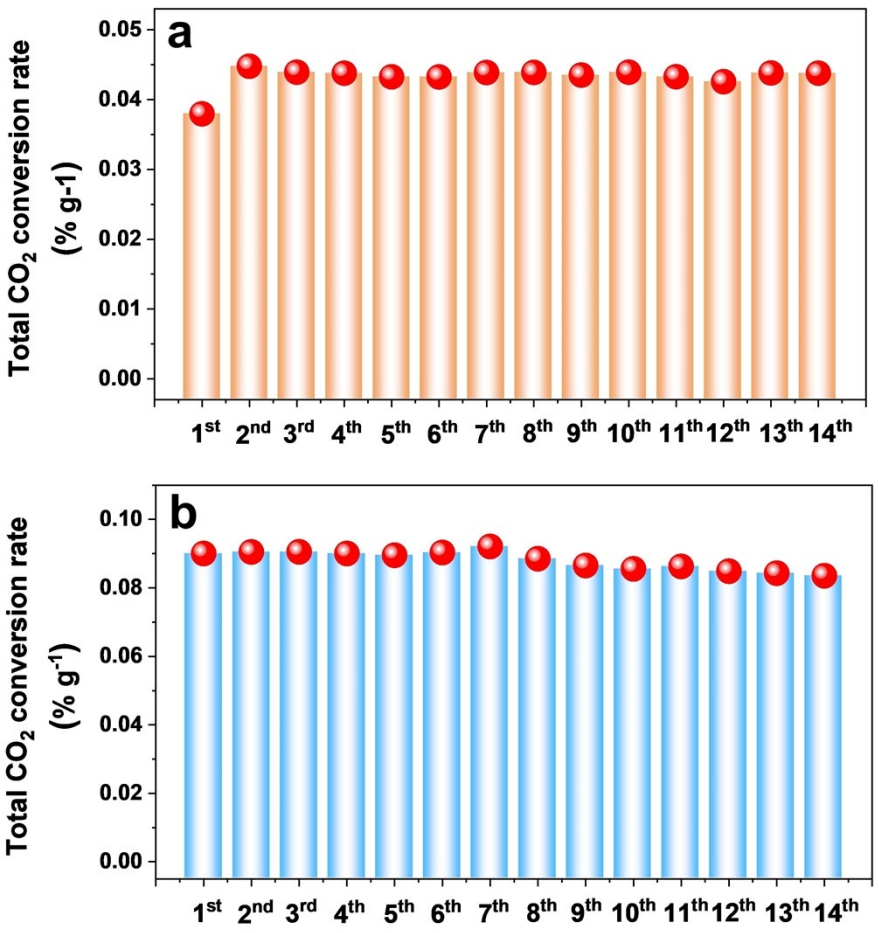

Fig. S8 Total CO_2 conversion rate for $Sm_{0.6}Sr_{0.4}MnO_3$ in 14 cycles at (a) 1300 ^oC/1000 ^oC and (b) 1300 ^oC/1300 ^oC redox reaction.

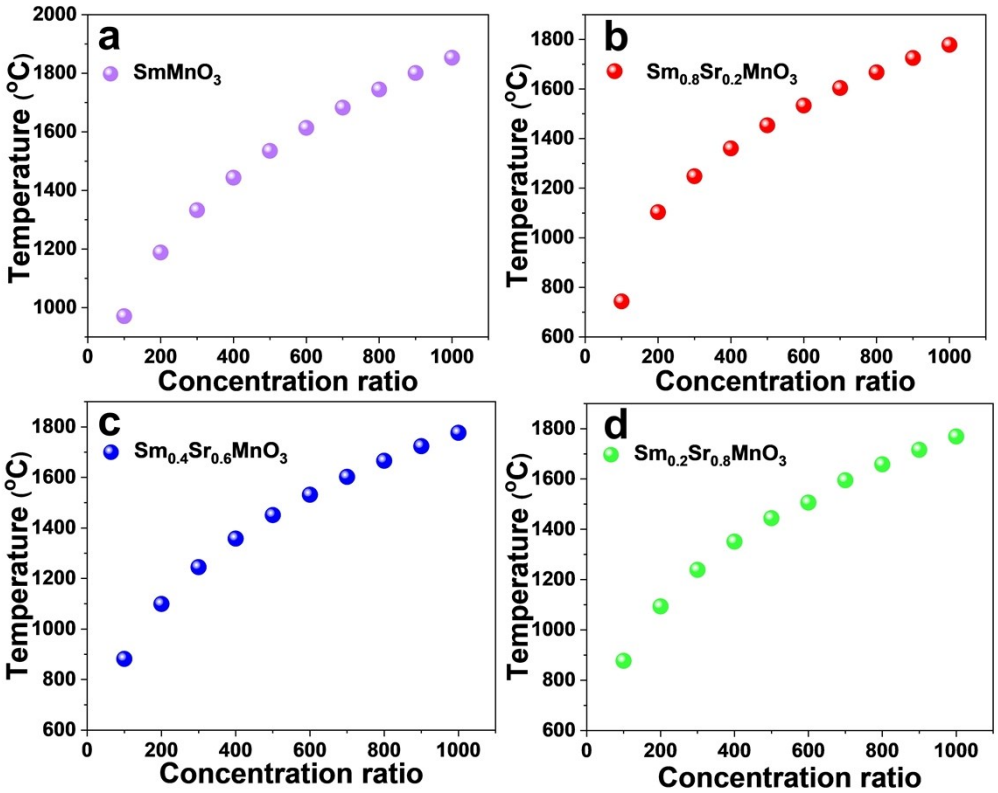

Fig. S9 Temperature varies with the concentration ratio for remaining samples.