Electronic Supplementary Information

Activity of layered swedenborgite structured $Y_{0.8}Er_{0.2}BaCo_{3.2}Ga_{0.8}O_{7+\delta}$ for oxygen electrode reactions in at intermediate temperature reversible ceramic cells

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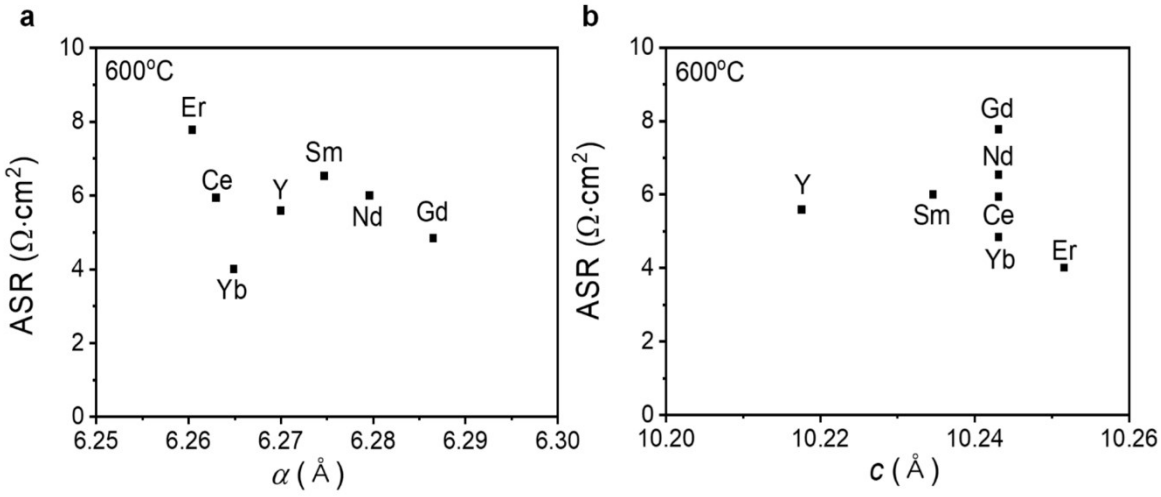

Fig. S1 a-b) ASRs of $Y_{0.9}Ln_{0.1}BaCo_4O_{7+\delta}$ (YLBC) symmetric cells as a function of cell parameters *a*- (a) and *c*-axes (b) at 600 ℃.

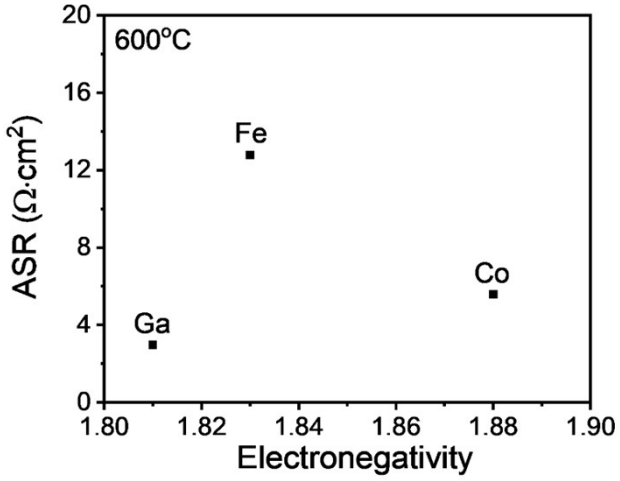

Fig. S2 ASRs of $YBaCo_{3.6}Tr_{0.4}O_{7+\delta}$ (YBCT) symmetric cells versus electronegativity of dopants at 600 ℃.

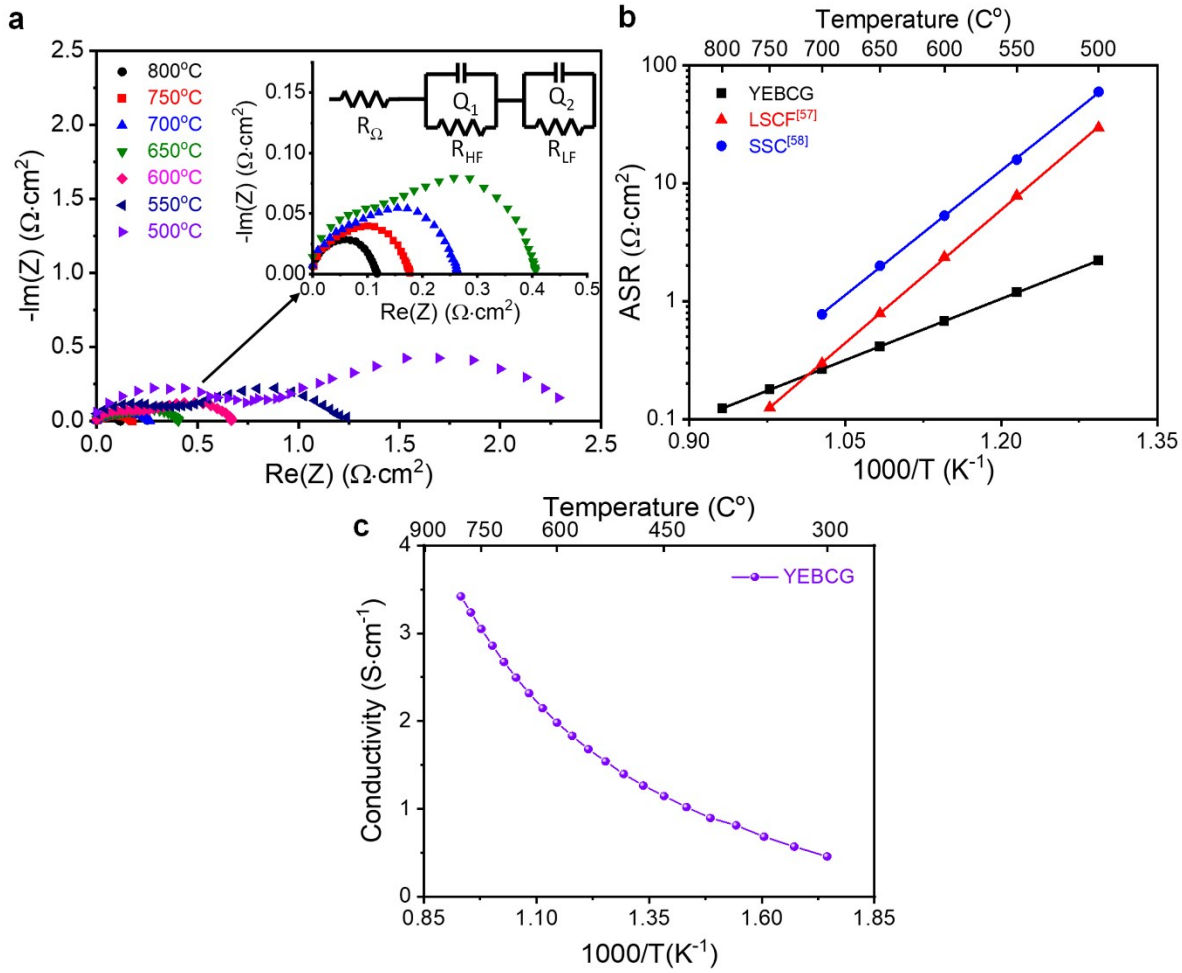

Fig. S3 a) EIS spectra of a YEBCG symmetric cell under OCV in ambient air at 500–700 °C. Inset shows two parallel R-Q circuits to fit the EIS data. b) Comparisons of ASRs of YEBCG to the other perovskite structured air electrode materials at intermediate temperatures. c) Electrical conductivity of the YEBCG in the temperature range of 300–800 ℃.

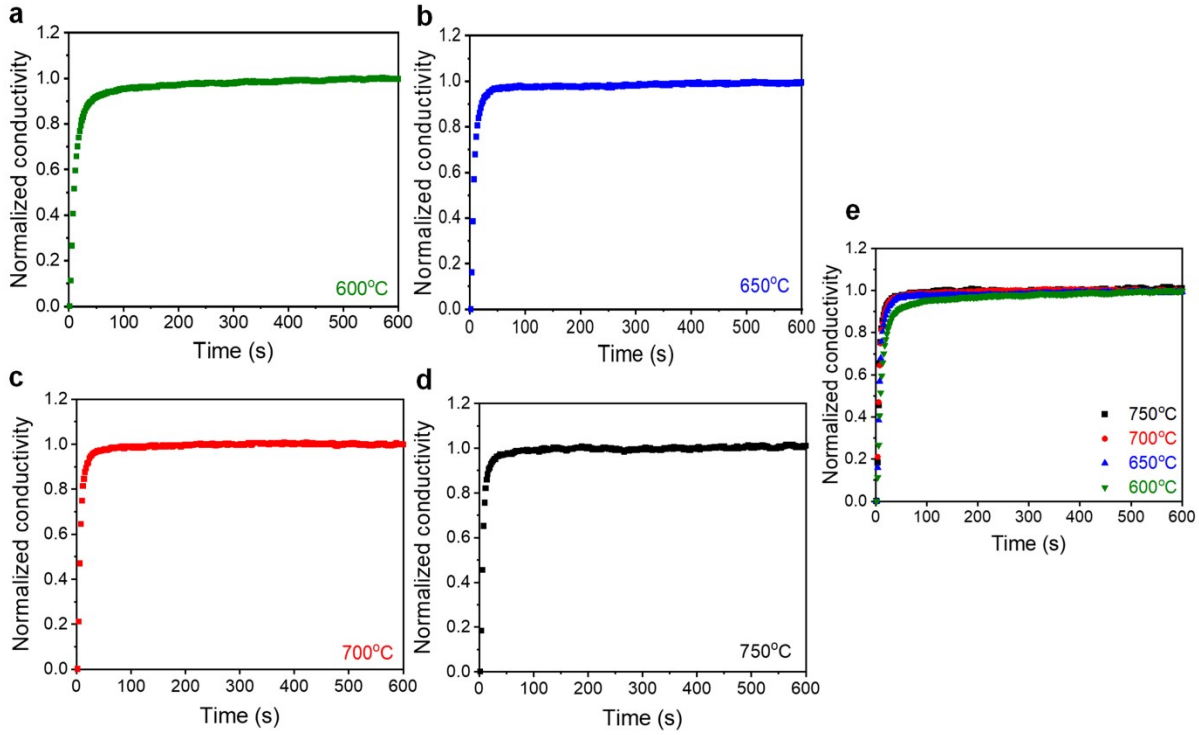

Fig. S4 Normalized electrical conductivity relaxation profiles of YEBCG after a sudden change in pO_2 ($-1.98 \leq \log(pO_2/\text{atm}) \leq -0.68$) at 600–750 ℃. a) 600 ℃. b) 650 ℃. c) 700 ℃. d) 750 ℃. e) 600–750 ℃.

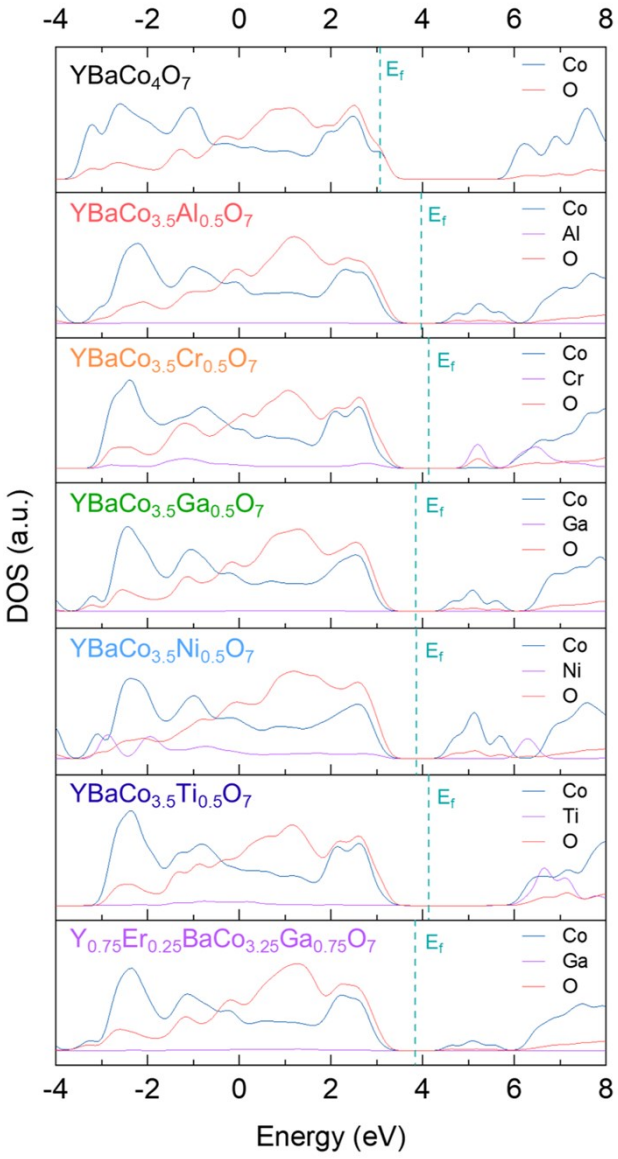

Fig. S5 Projected DOS of $Y_{1-x}Er_xBaCo_{4-y}Tr_yO_{7+\delta}$ (x = 0.25; y = 0.5 and 0.75; Tr = Ga, Ni, Cr, Al, and Ti). E_f is fermi level.

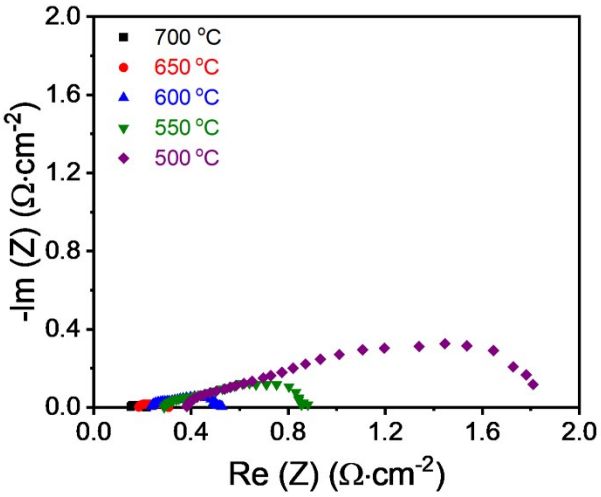

Fig. S6 EIS spectra of YEBCG RPCCs under OCV (3% humidified H_2 Fuel and air) at 500–700 ℃.

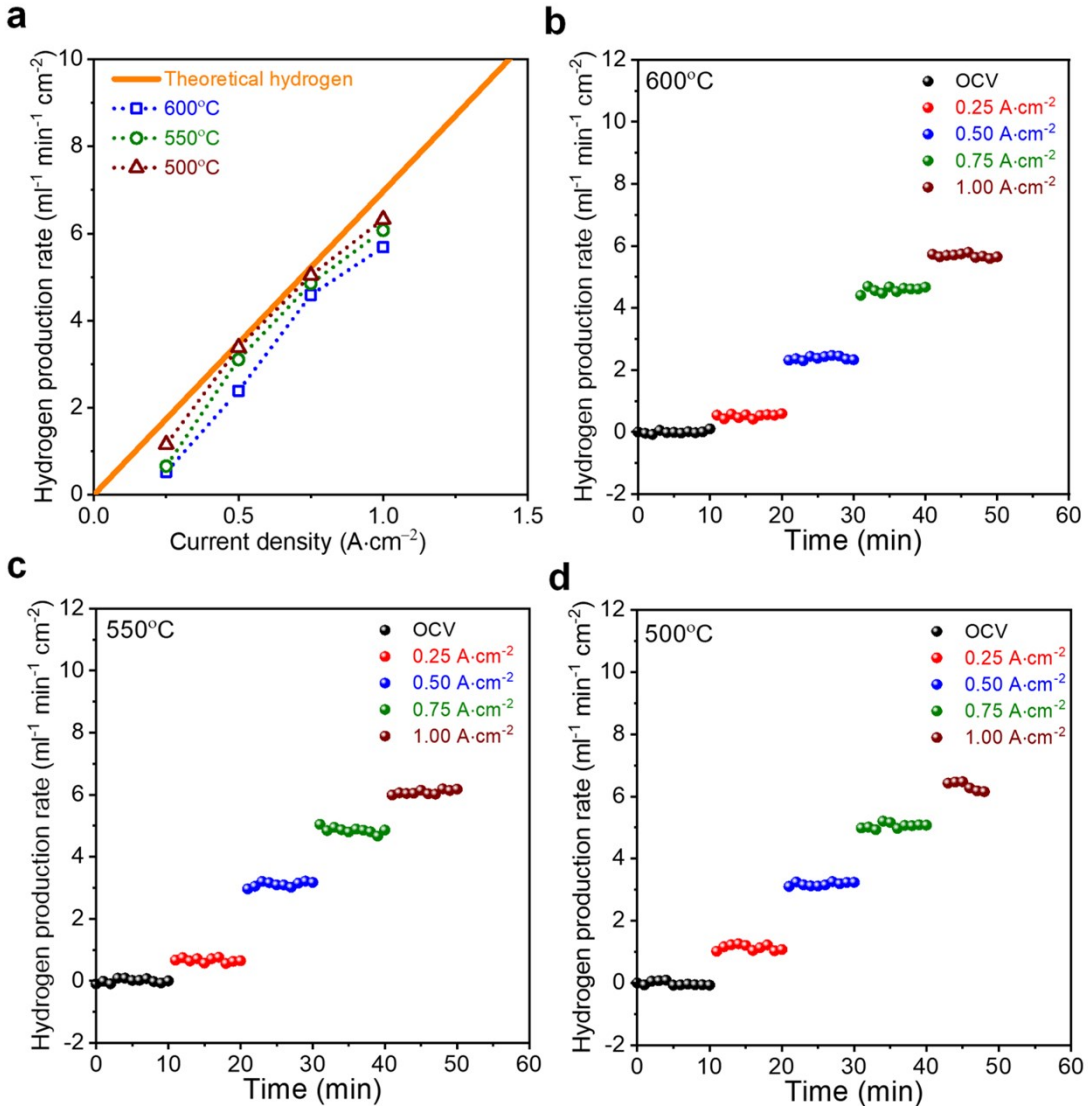

Fig. S7 Faradaic efficiencies of YEBCG cell at 500–600 ℃. (a) Hydrogen production rates as a function of current density with theoretical values. (b-d) Hydrogen production rate as a function of time scale at (b) 600, (c) 550, and (d) 500 ℃ under applied current density 0.25–1 $A \cdot cm^{-2}$.