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Supplementary information

Promotion of oxygen reduction and evolution by applying a nanoengineered hybrid catalyst on cobalt free electrodes for solid oxide cells

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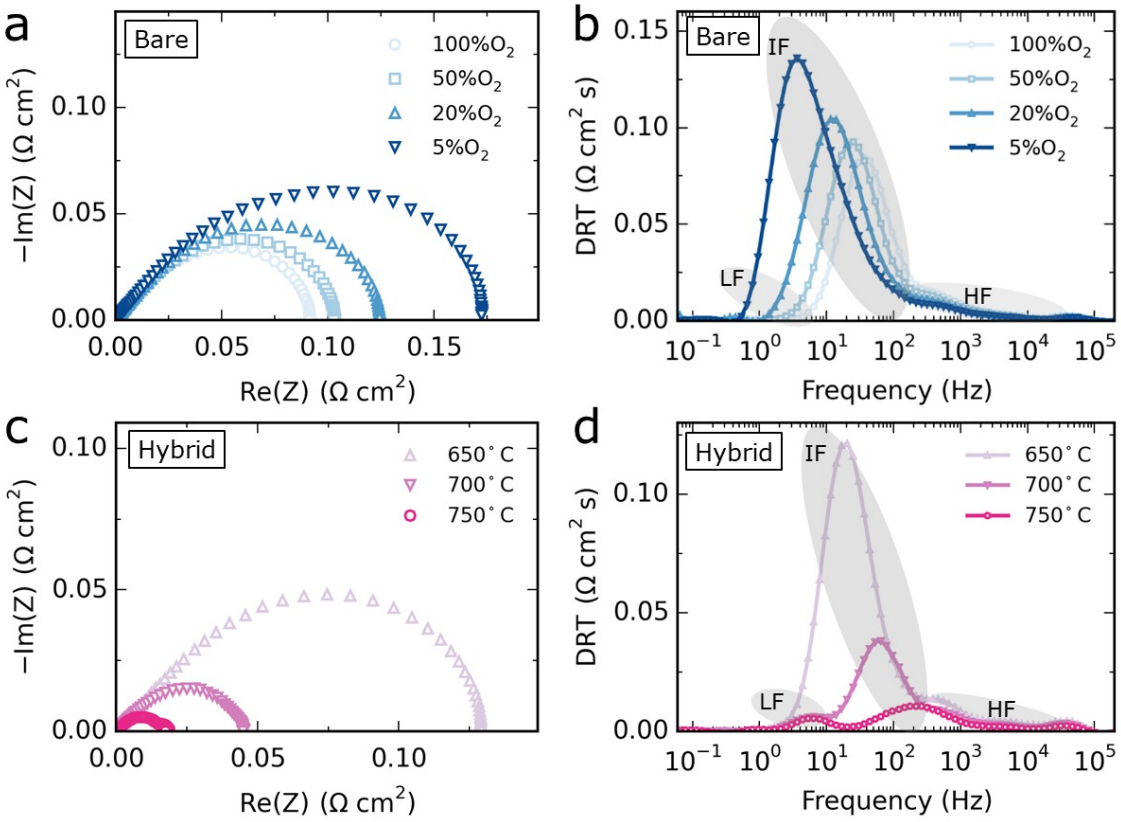

Fig. S1 Electrochemical performance on symmetrical cells. Effects of oxygen partial pressure (pO_2) on the EIS data of bare LSF electrodes at 750 °C. (a) Nyquist plots and (b) DRT plots. Effects of temperature on the EIS data of hybrid modified LSF electrodes in dry air. (c) Nyquist plots and (d) DRT plots.

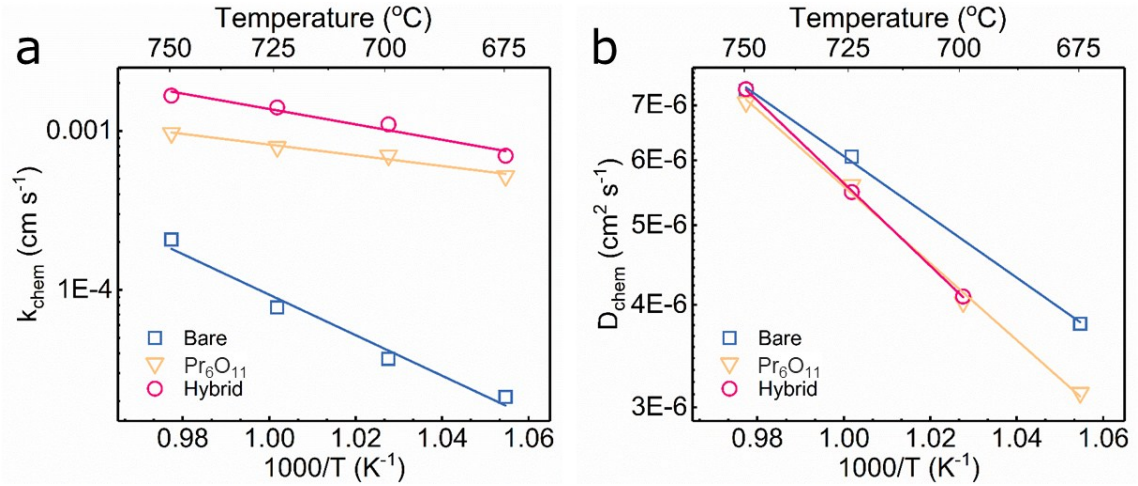

Fig. S2 (a) Surface exchange coefficient (k_{chem}) and (b) chemical diffusion coefficient (D_{chem}) of the bare LSF, Pr_6O_{11}-coated LSF, and hybrid-catalyst-coated LSF electrodes obtained from the ECR measurements.

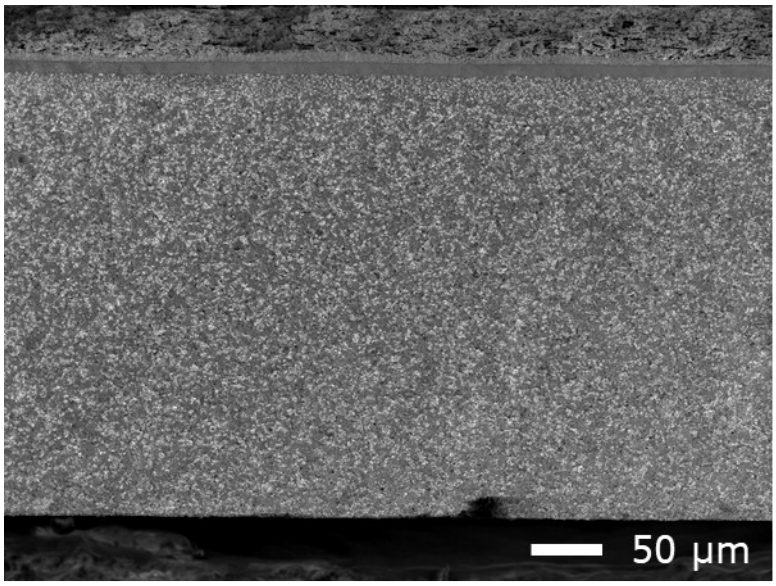

Fig. S3 Cross-sectional SEM image of fuel-electrode-supported cells with a configuration of Ni/YSZ support | Ni/YSZ fuel electrode | YSZ electrolyte | CGO10 barrier | hybrid-catalyst-coated LSF oxygen electrode (hybrid-catalyst-coated LSF cell).

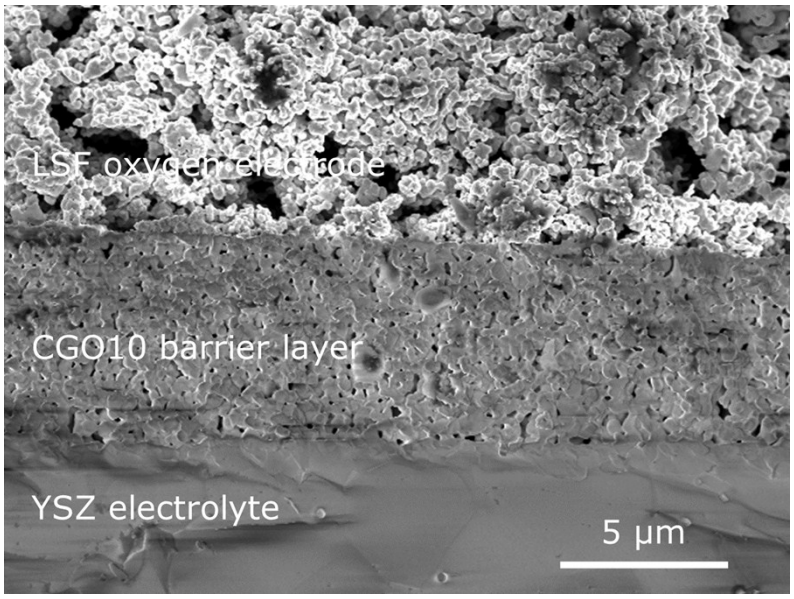

Fig. S4 Cross-sectional SEM image of fuel-electrode-supported cell showing a porous CGO10 barrier layer.

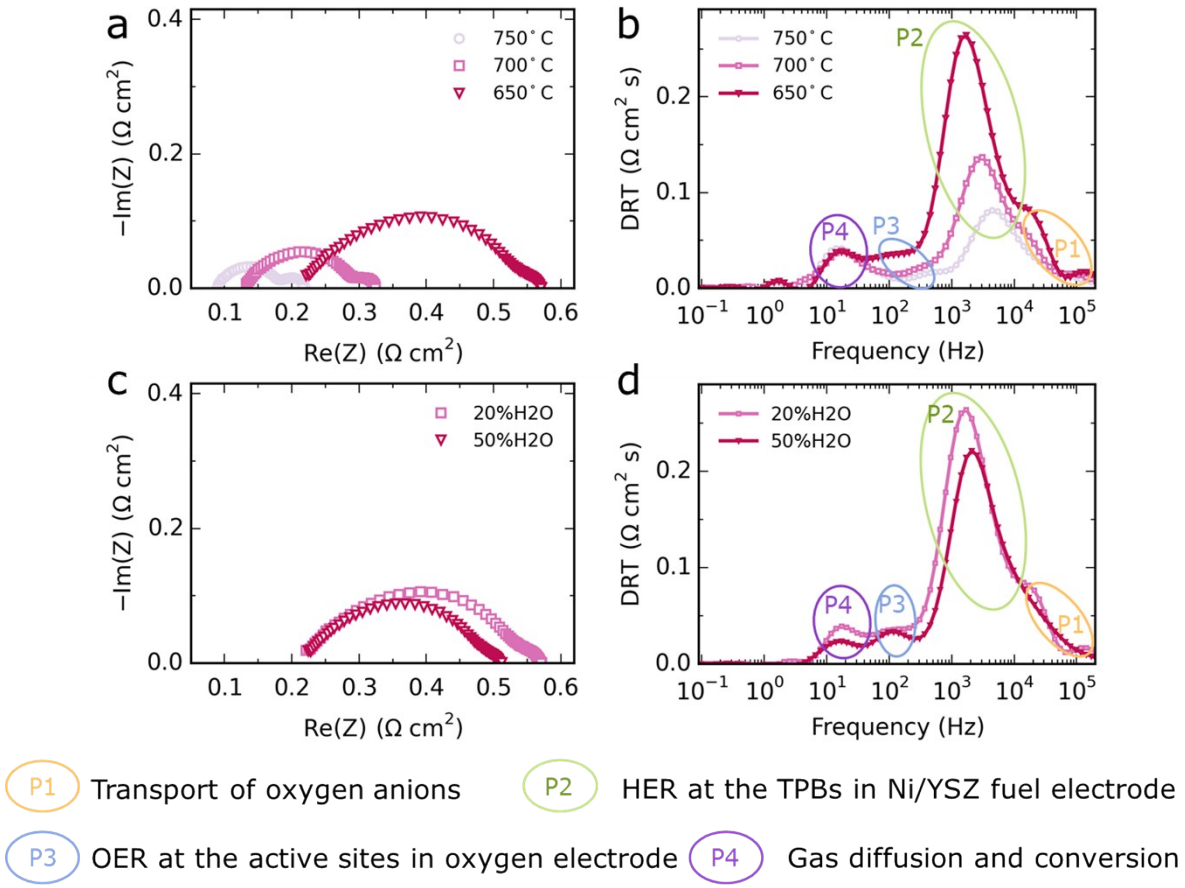

Fig. S5 EIS data on Ni/YSZ fuel-electrode-supported cells with the hybrid-coated LSF oxygen electrode measured under OCV conditions. Effects of temperature on the EIS date recorded with 20%H_2O-80%H_2 fed to the fuel electrode and dry air to the oxygen electrode. (a) Nyquist plots and (b) DRT plots. Effects of steam content in the fuel electrode on the EIS data recorded at 650 °C. (c) Nyquist plots and (d) DRT plots.

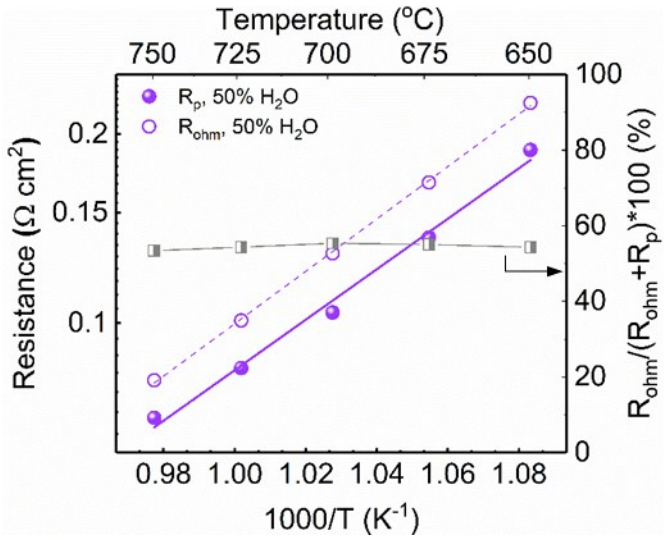

Fig. S6 R_p and R_{ohm} plotted as a function of inverse temperature, measured on the double-side modified cell (with the CGO20-coated Ni/YSZ fuel electrode and the hybrid-catalyst-coated LSF oxygen electrode) with 50%H_2O-50%H_2 fed to the fuel electrode and dry air to the oxygen electrode.