# Improved mesostructured oxygen electrodes for highly performing solid oxide cells for co-electrolysis of steam and carbon dioxide

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## SUPPLEMENTARY INFORMATION

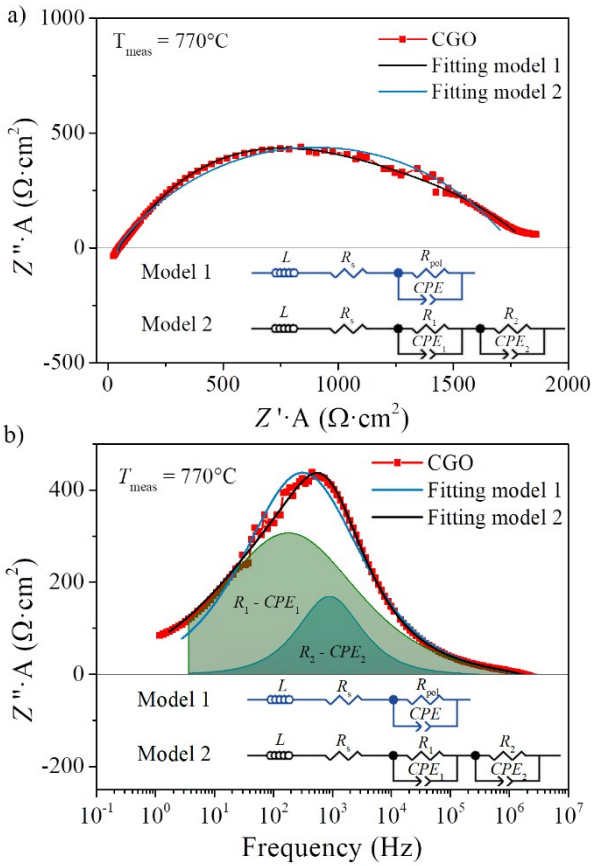


**Figure S1**. S1a) Nyquist plot ($T$ =770°C) of a YSZ/mesoporous CGO test cell is shown with the equivalent circuits used for the fitting. S1b) Bode plot with the two different fitting models. The single $R_i$ - $CPE_i$ are highlighted.

Impedance spectroscopy measurements were carried out on YSZ/mesoporous CGO test cells. Figure S1a shows a representative Nyquist plot at 700 °C. Two different equivalent circuits were taken into account to fit the spectrum: the *model 1* composed by an $R_pQ$ element in series with an inductance ($L$) and a serial resistance ($R_s$) and the *model 2* with two $R_pQ$ in series. The bode plot of panel S1b, highlights the inaccuracy of the fitting obtained by model 1, while the asymmetry of the arc is perfectly fitted by circuit model 2.

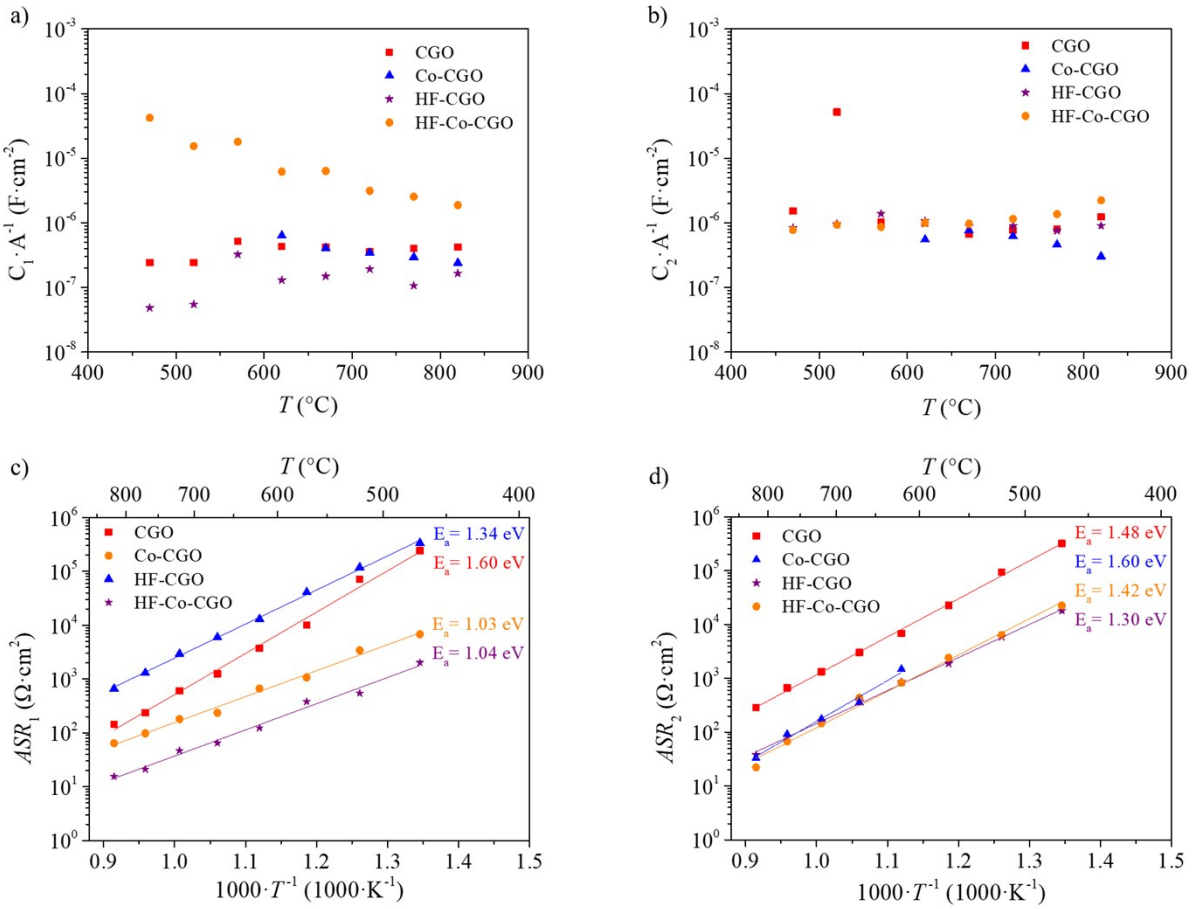


**Figure S2.** Resulting EIS fitting parameters for symmetric CGO/YSZ cells as a function of temperature. The high (low) frequency arc true capacitance and area specific resistance are reported in panels a (b) and c (d), respectively.

The results of the fittings of the impedance arcs related to symmetric mesoporous CGO/YSZ cells are reported in Figure S2 (the fitting model is "model 2" in Figure S1). The two contributions are characterized by similar activation energies (1-1.5 eV) and capacitances ($10^{-7}$-$10^{-6}$ F·cm$^{-2}$) and should

therefore be attributed to very similar phenomena arguably related to solid-gas reactions, i.e. the Au/ceria/gas TPB reaction and the oxygen exchange at the ceria surface.[1] Alternatively, one can imagine that a slight difference in the microstructural parameters (i.e thickness and density) of the two electrodes may lead to a different in the characteristic time response for each electrode.

**Supplementary references**

1 A. Flura A., C. Nicollet, S. Forucade, V. Vibhu, A. Rougier, J-M Bassat, J-C. Grenier, Electrochem. Acta 2015, 174, 1030-1040