

Supplementary information

Designing a protonic ceramic fuel cell with novel electrochemically active oxygen electrodes based on doped $\text{Nd}_{0.5}\text{Ba}_{0.5}\text{FeO}_{3-\delta}$

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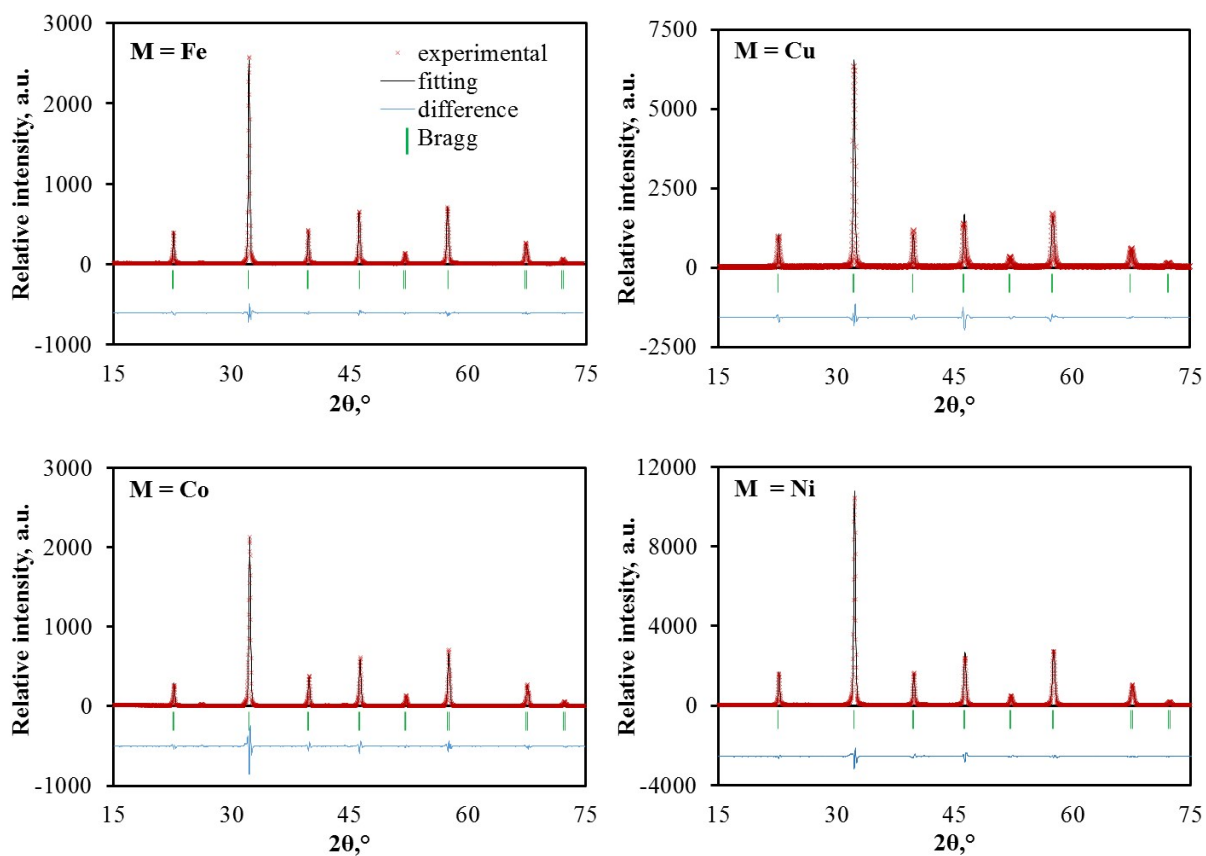


Fig. S1 Rietveld refinement results of the $\text{Nd}_{0.5}\text{Ba}_{0.5}\text{Fe}_{0.9}\text{M}_{0.1}\text{O}_{3-\delta}$ sintered at 1250 °C in ambient atmosphere. The values of the χ^2 and R_{BR} factors for all the samples did not exceed 2.52 and 1.07, respectively.

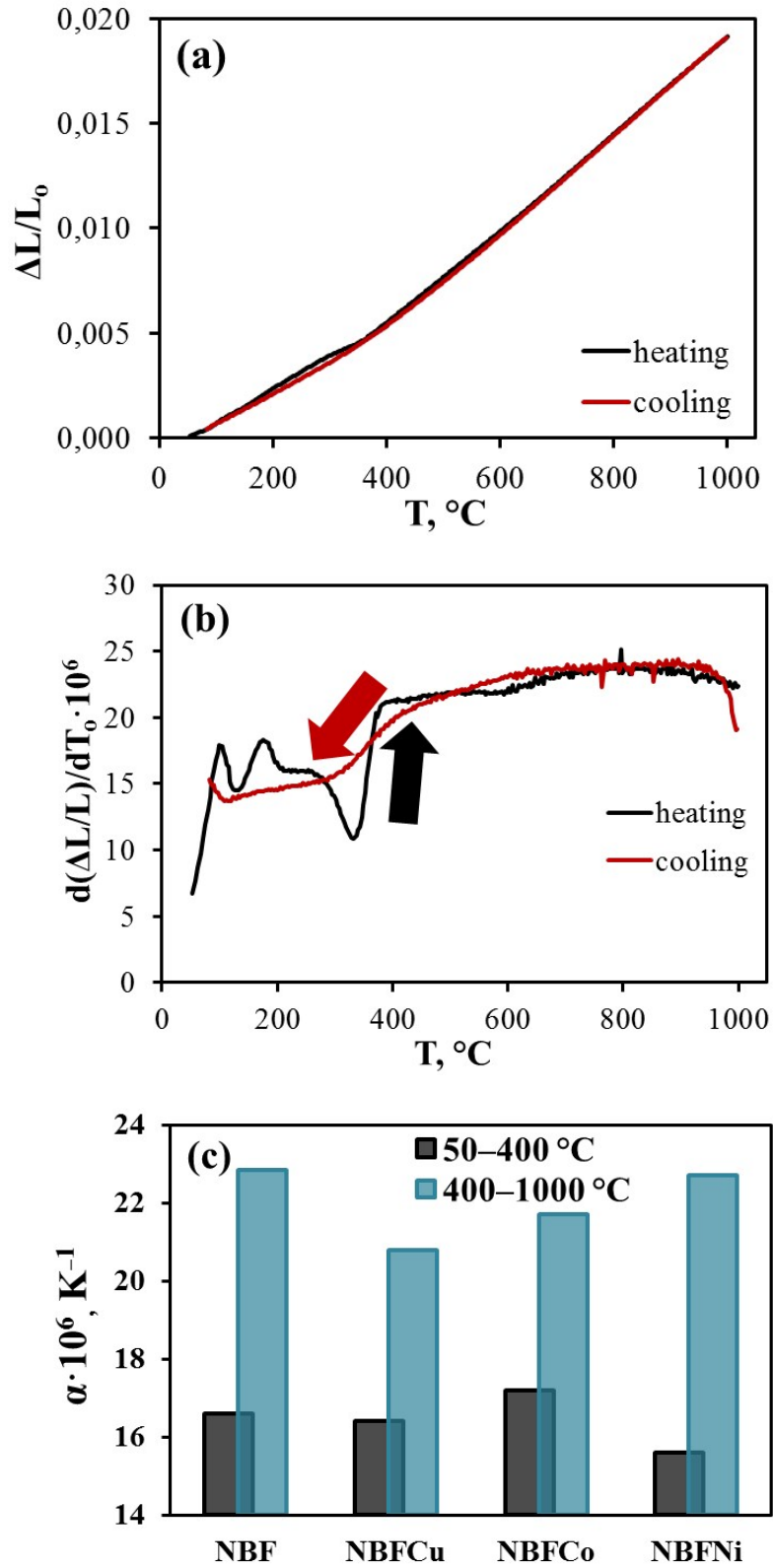


Fig. S2 (a) Example of the relative linear changes of the $Nd_{0.5}Ba_{0.5}Fe_{0.9}M_{0.1}O_{3-\delta}$ ceramic materials under cooling/heating regimes. (b) The corresponding differential thermal expansion coefficient values. (c) Average TEC values determined within the linear intervals of the dilatometric curves (low- and high-temperature ranges) in heating mode.

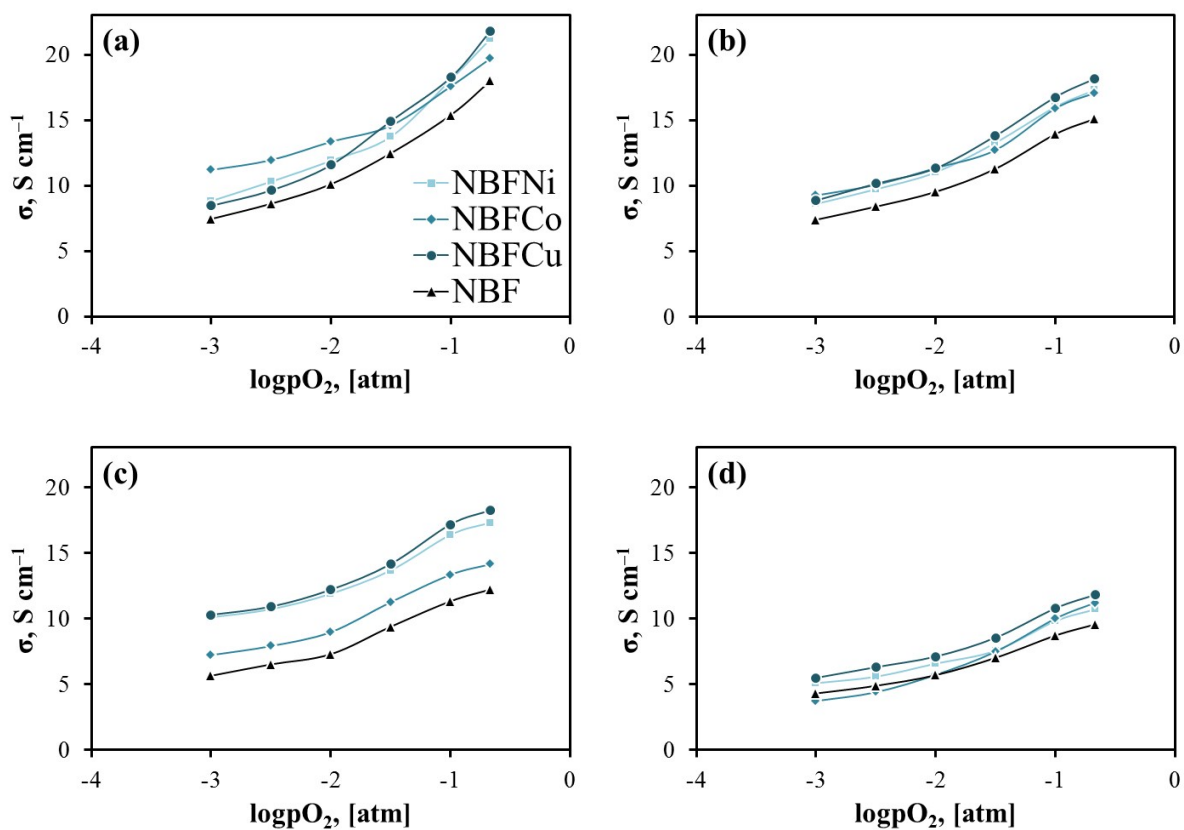


Fig. S3 Total conductivity of the $\text{Nd}_{0.5}\text{Ba}_{0.5}\text{Fe}_{0.9}\text{M}_{0.1}\text{O}_{3-\delta}$ ceramic materials as a function of oxygen partial pressure at 600 °C (a), 700 °C (b), 800 °C (c) and 900 °C (d).

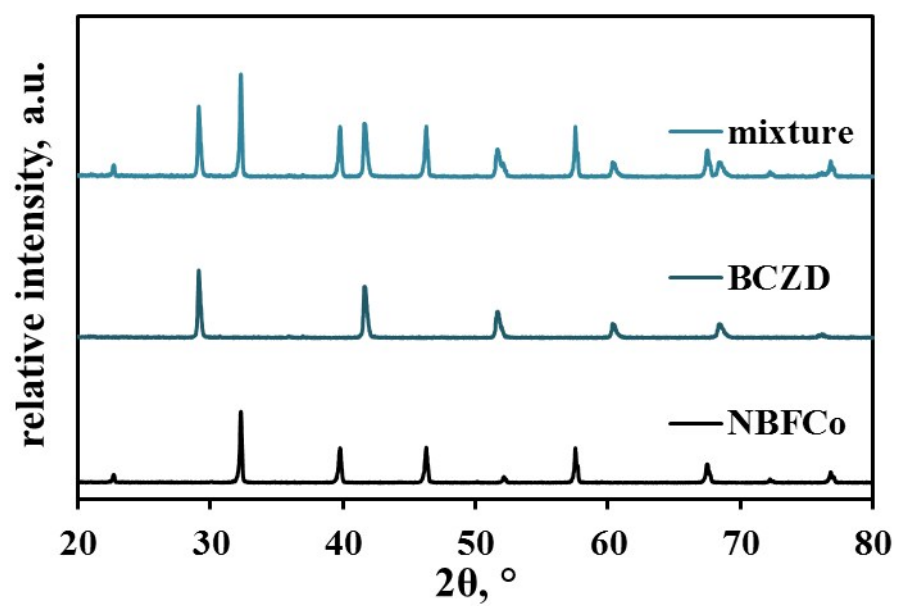


Fig. S4 Phase relation in the NBFCo and BCZD mixture calcined at 1100 °C for 10 h.

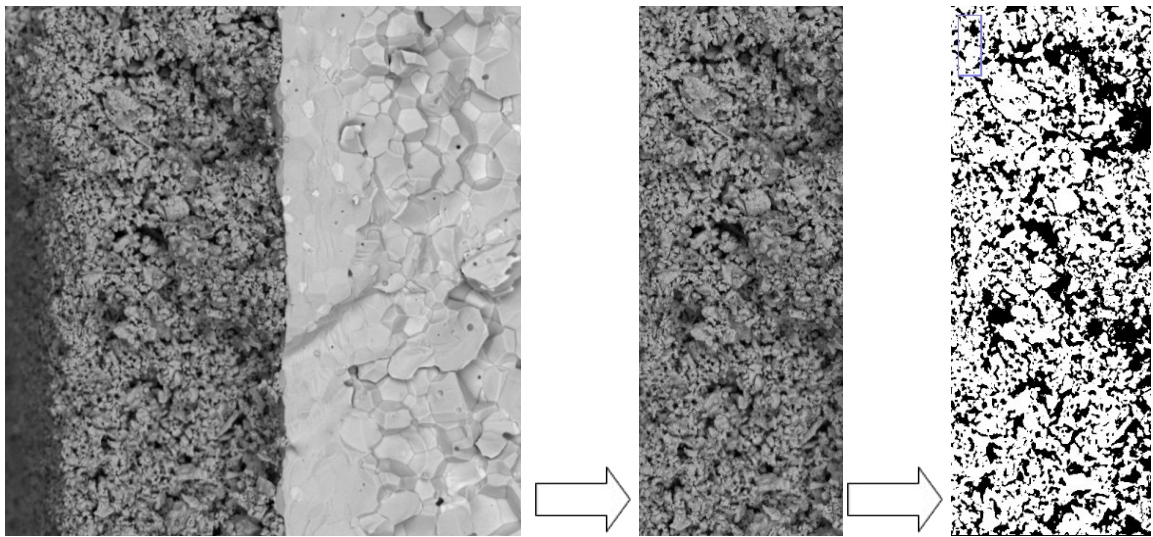


Fig. S5 The result of porosity analysis using the ImageJ software.

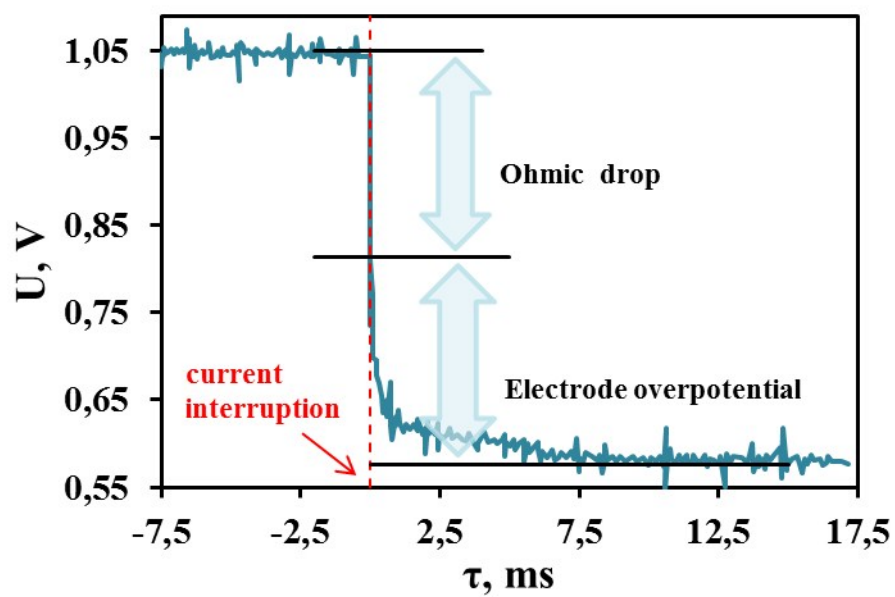


Fig. S6 Example of dynamic change of PCFC's voltage at 600 °C under the current interruption procedure.