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## Supplementary Material

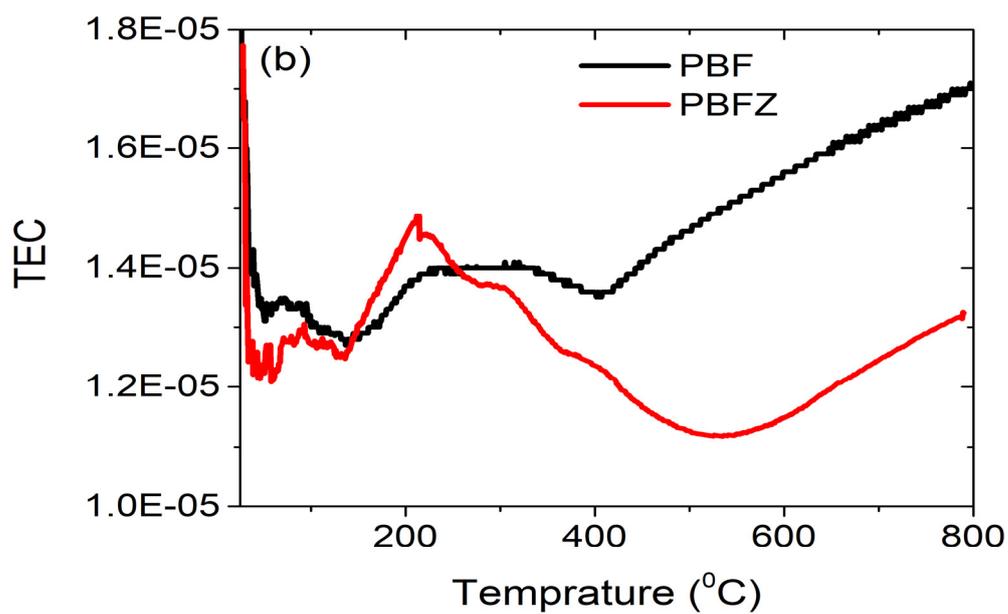
### Promoted performance of layered perovskite $\text{PrBaFe}_2\text{O}_{5+\delta}$ cathode for protonic ceramic fuel cells by Zn doping

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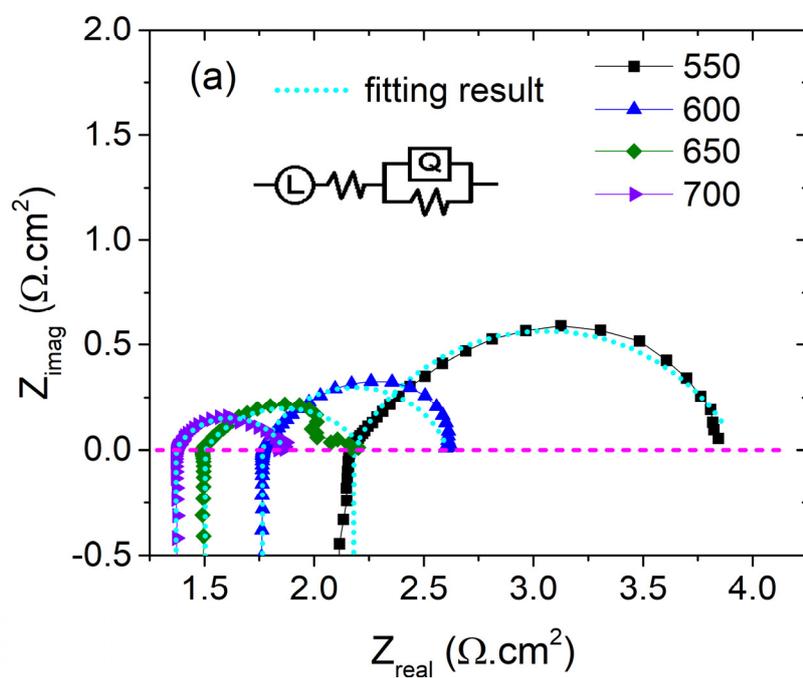
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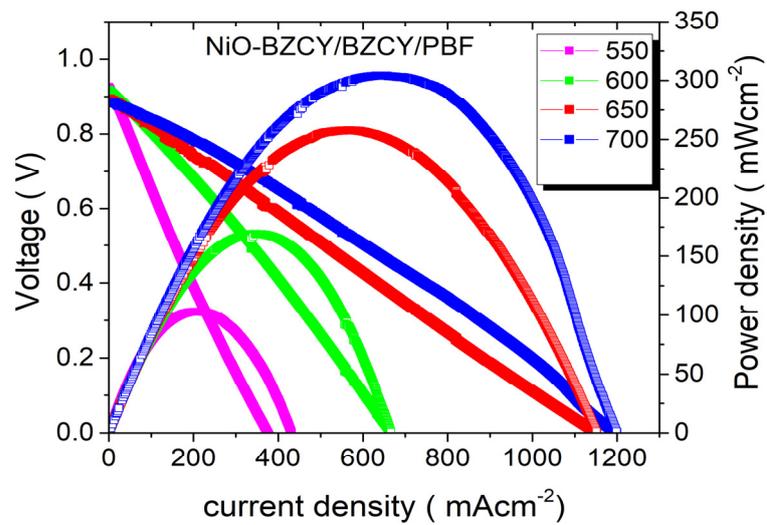
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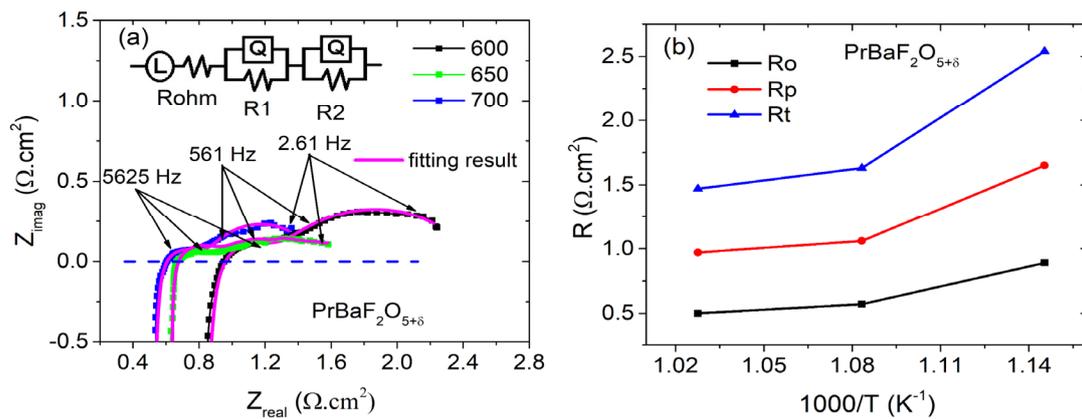
**Figure S1.** Thermal expansion coefficient of the PBFZ and PBF samples between room temperature and 800 °C.



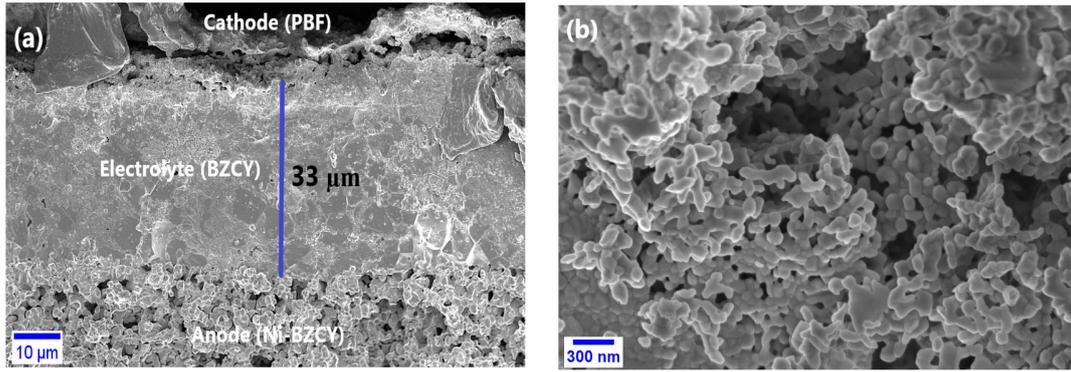
**Figure S2.** Nyquist plots of a symmetric PBF|SDC|PBF cell at different temperatures.



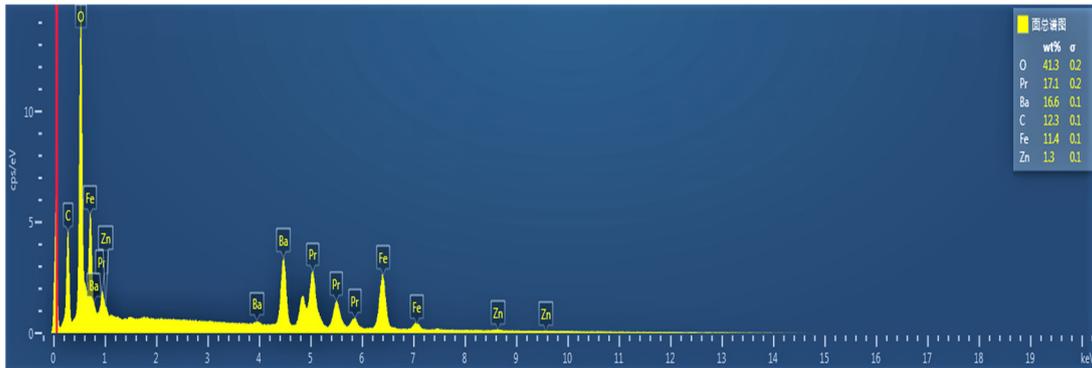
**Figure S3.** I–V–P curves of single-cell based on PBF cathode operated from 550 °C to 700 °C, with humidified H<sub>2</sub> (3% H<sub>2</sub>O) as anode fuel and ambient air as oxidant.



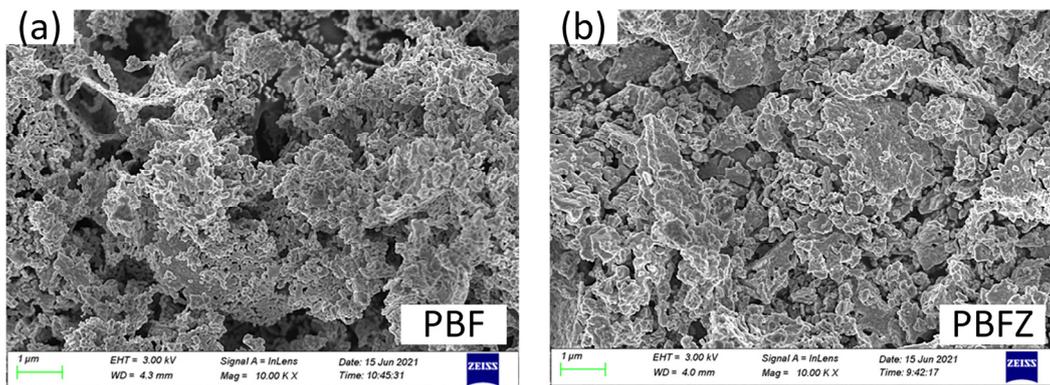
**Figure S4.** (a) Impedance spectra for single cells with PBF cathode measured under open-circuit conditions at different temperatures in the range of 600–700 °C. (b) The interfacial polarization resistances ( $R_p$ ), ohmic resistances ( $R_o$ ), total resistance ( $R_t$ ), obtained from the impedance spectra at different temperatures of the cell.



**Figure S5.** SEM micrographs of cell after testing: (a) the cross-section of tri-layer cell with PBF cathode and BZCY electrolyte (b) microstructure of PBF cathode.



**Figure S6.** Energy dispersive spectrum (EDX) results for PBFZ powder calcined at 1000 °C.



**Figure S7.** Microstructure results for (a) PBF and (b) PBFZ cathod after testing.