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Supporting Information

# Separation of Hydrogen Isotopes using a proton ceramic fuel cell

*Meilong Chen,[ac] Kai Zhao,[ab] Jun Li,[ab] Guixiang Lin,[b] Dustin Banham,[ab] Li Du [c] and Min Chen *[ab]*

[a] *School of Materials Science and Energy , Foshan University, Foshan 528000, P.R.China.*

[b] *Guangdong Key Laboratory for Hydrogen Energy Technologies, Foshan 528000, P.R.China.*

[c] *School of Chemistry and Chemical Engineering, South China University of Technology, Guangzhou 510640, P.R.China.*

**Corresponding authors. Email address: minchen1981@126.com.*

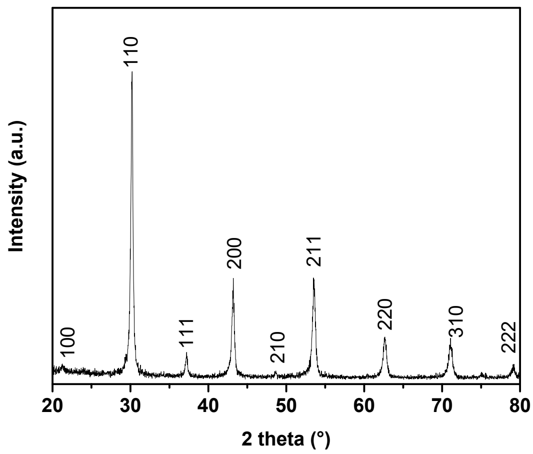


**Figure S1** XRD pattern of the BZY powder calcined at 1150 °C for 10 h.

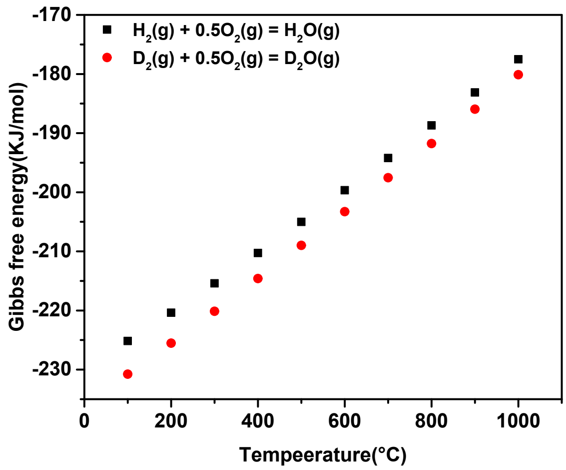


**Figure S2** Gibbs free energy change values for the reaction of $H_2$ (g)+0.5$O_2$ (g) = $H_2O$ (g) and $D_2$ (g)+0.5 $O_2$ (g) = $D_2O$ (g) .

***Calculation of Separation Factor Values:*** The hydrogen/deuterium separation factor (a) can be calculated using the equations below;

$$\alpha = \left(\frac{[\mathrm{H}]}{[\mathrm{D}]}\right)_L : \left(\frac{[\mathrm{H}]}{[\mathrm{D}]}\right)_G \quad (1)$$

Where$[H]_L$, $[D]_L$, and $[H]_G$, $[D]_G$ represent the liquid-phase quantities of the isotopes at the cathode and the gas-phase isotopes at the anode expressed as concentrations, respectively. In infrared spectroscopy, the isotopic content corresponds to the area of the corresponding peak. Assuming that the peak area of the $D_2O$ is A, the peak area of the HDO is B, and the peak area of the HD is C, the $[D]_L$and $[H]_L$ concentration can be obtained by the following equation;

$$[\mathrm{D_2O}] = [\mathrm{D}]_\mathrm{L} = \frac{\mathrm{A} + \mathrm{B}/2}{\mathrm{A} + \mathrm{B} + \mathrm{C}} \quad (2)$$

$$[\mathrm{H_2O}] = [\mathrm{H}]_\mathrm{L} = \frac{\mathrm{C} + \mathrm{B}/2}{\mathrm{A} + \mathrm{B} + \mathrm{C}} \quad (3)$$

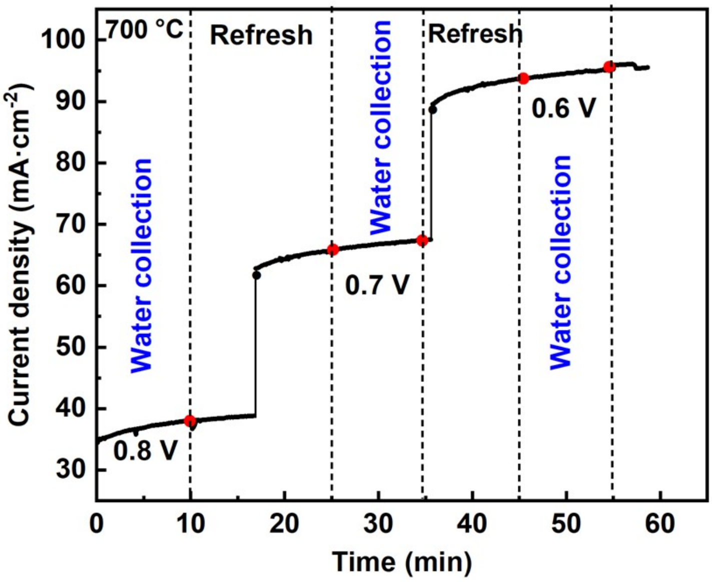


**Figure S3** Current density of BZY20-based cells tested in a potential static mode under 1:1-$H_2$+$D_2$ fuel at 700°C;