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SUPPLEMENTARY INFORMATION

High-performance thin-film protonic ceramic fuel cells fabricated on anode supports with a non-proton-conducting ceramic matrix

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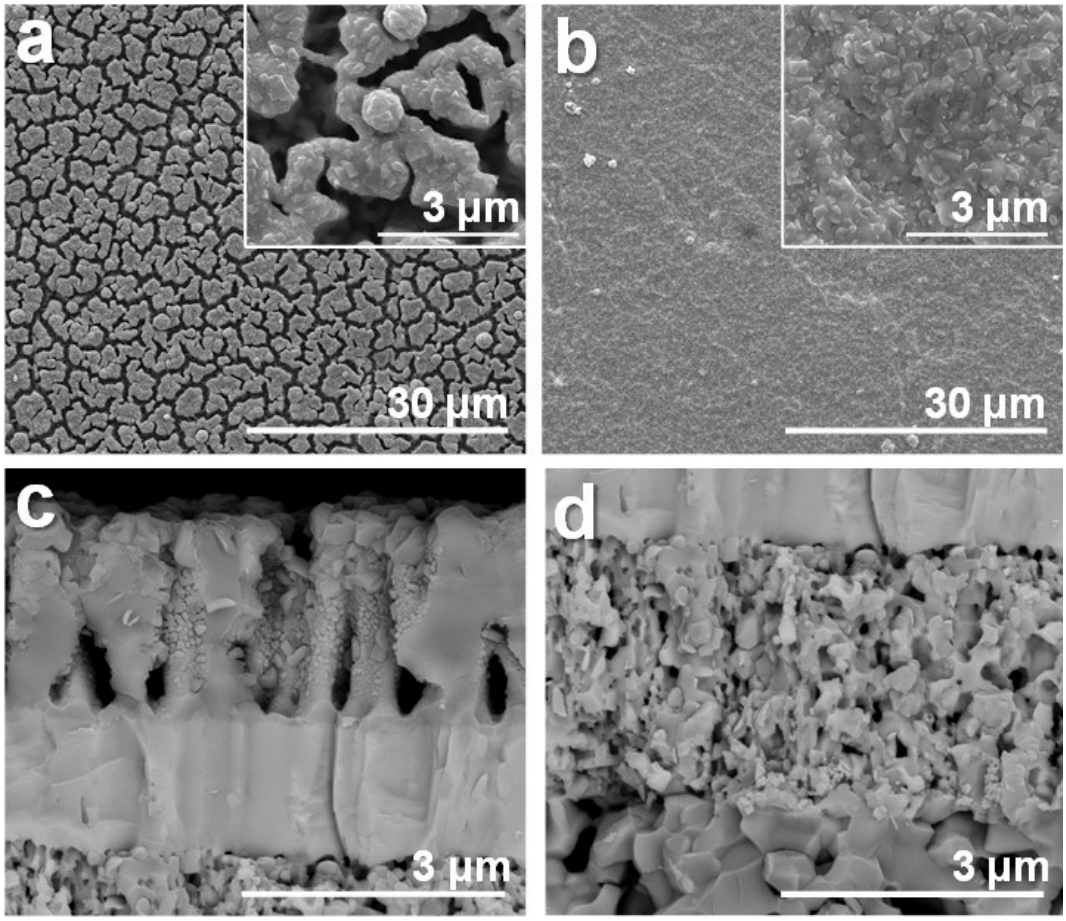

Fig. S1. Surface and cross-sectional scanning electron microscopy images of the BY-Cell that consists of a $Ba_{0.5}Sr_{0.5}Co_{0.8}Fe_{0.2}O_{3-\delta}$ cathode, a $BaCe_{0.55}Zr_{0.3}Y_{0.15}O_{3-\delta}$ (BCZY) electrolyte, a Ni–BCZY anode, and a Ni–yttria-stabilized zirconia (YSZ) support. Top view of (a) porous cathode and (b) dense electrolyte, and cross-section view of (c) cathode-electrolyte-anode and (d) electrolyte-anode-support.

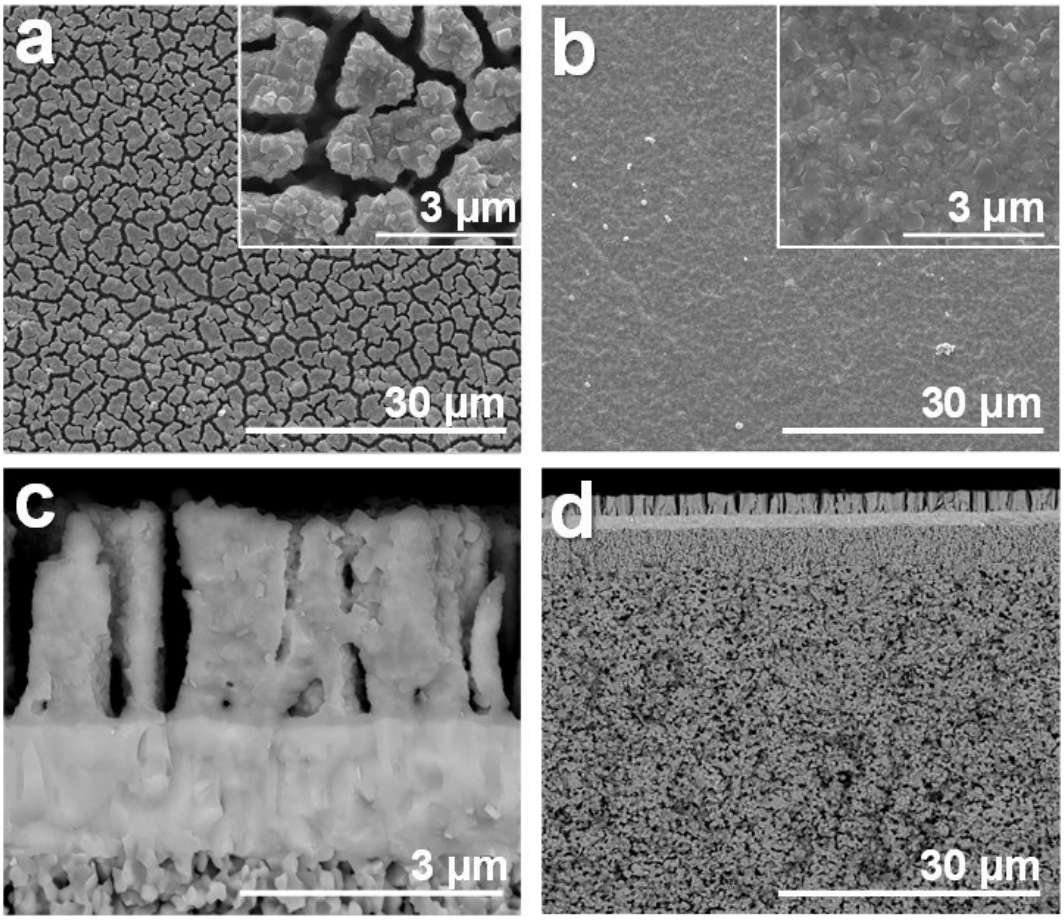

Fig. S2. Surface and cross-sectional scanning electron microscopy images of the YY-Cell that consists of a BSCF cathode, a BCZY electrolyte, a Ni–YSZ anode, and a Ni–YSZ support. Top view of (a) porous cathode and (b) dense electrolyte, and cross-section view of (c) cathode-electrolyte-anode and (d) the entire cell at low magnification.

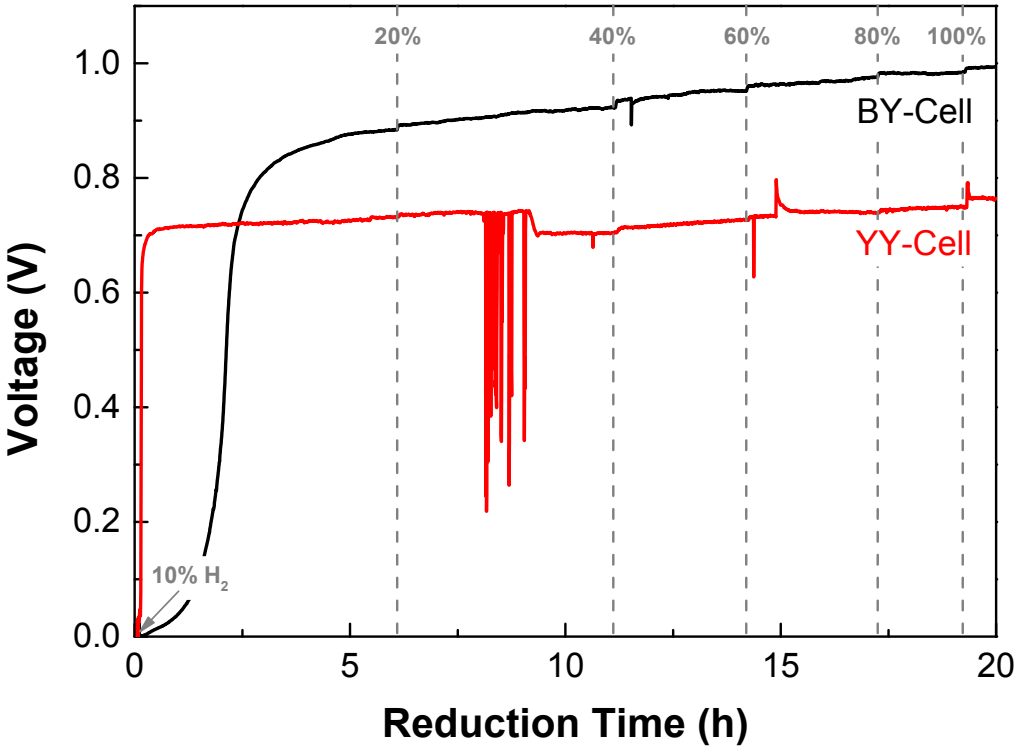

Fig. S3. Open circuit voltage profiles of the BY- and YY-Cell obtained via an anode reduction process at 600 °C.

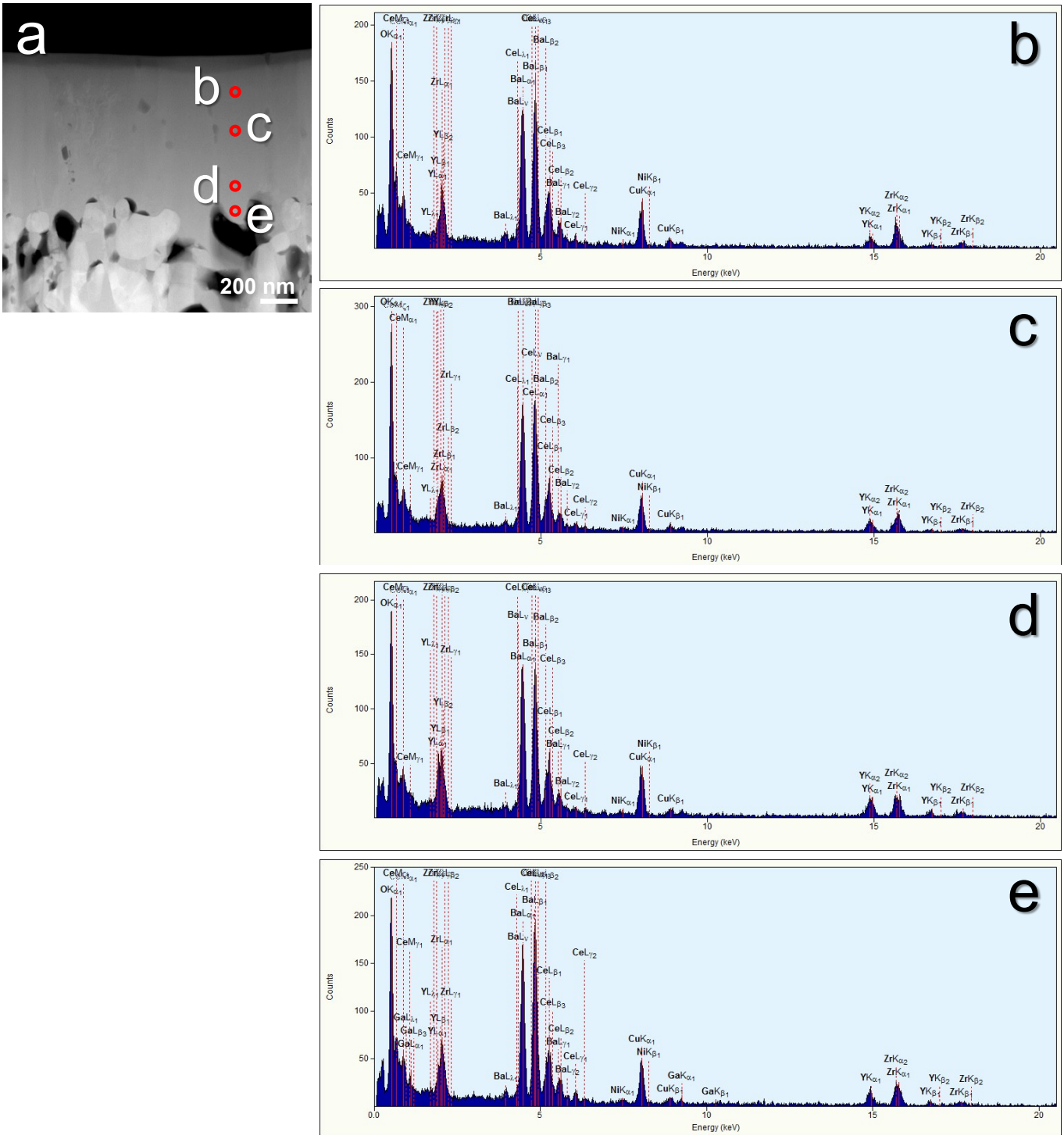

Fig. S4. A scanning transmission electron microscopy image of BY-Cell (a) and energy dispersive X-ray spectroscopy patterns (b)–(e) obtained at the positions marked as red dots in (a), corresponding to the comparison data set of relative cation concentration in Fig. 6(a) and (b) in the manuscript.

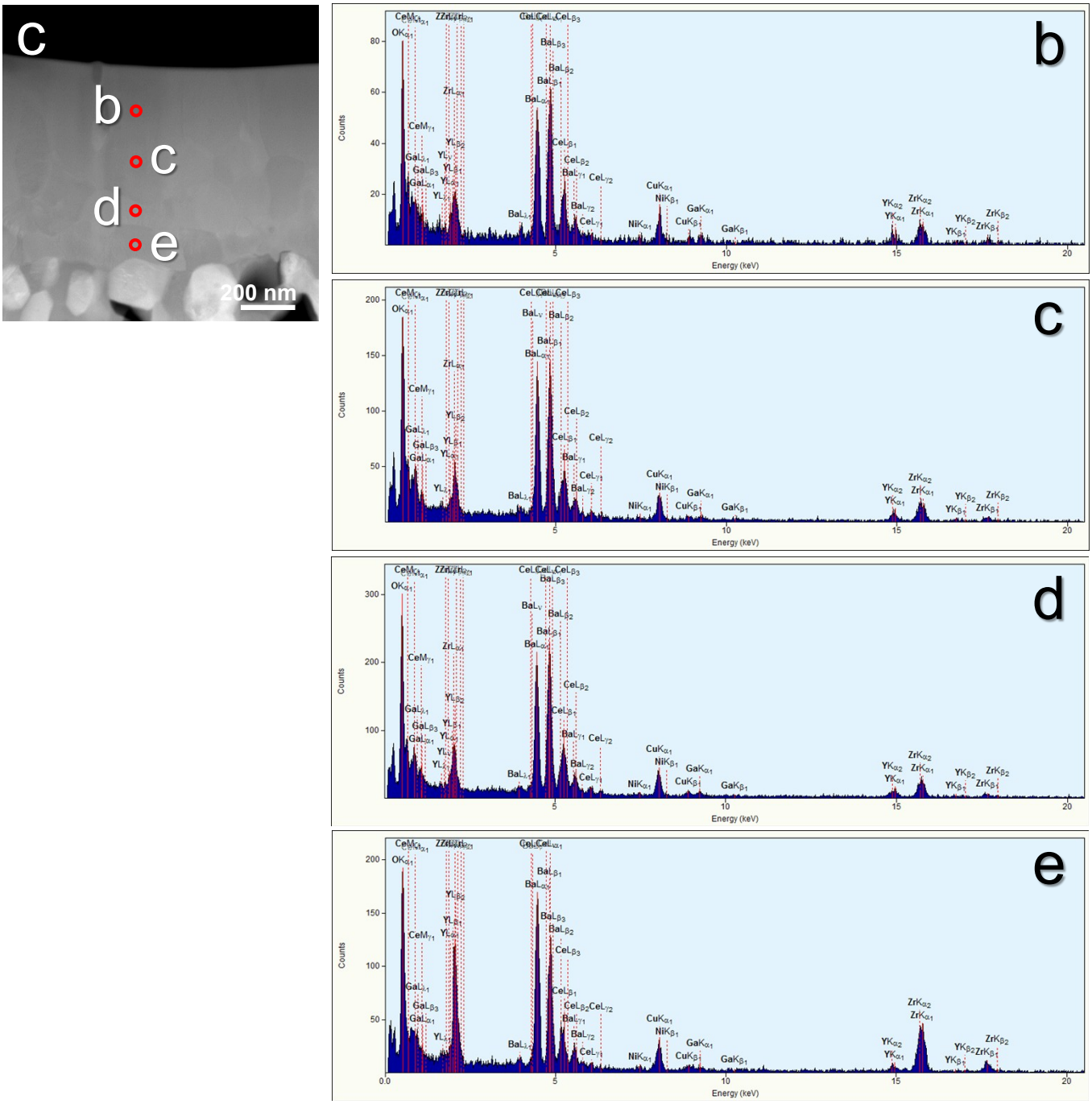

Fig. S5. A scanning transmission electron microscopy image of YY-Cell (a) and energy dispersive X-ray spectroscopy patterns (b)–(e) obtained at the positions marked as red dots in (a), corresponding to the comparison data set of relative cation concentration in Fig. 6(c) and (d) in the manuscript.

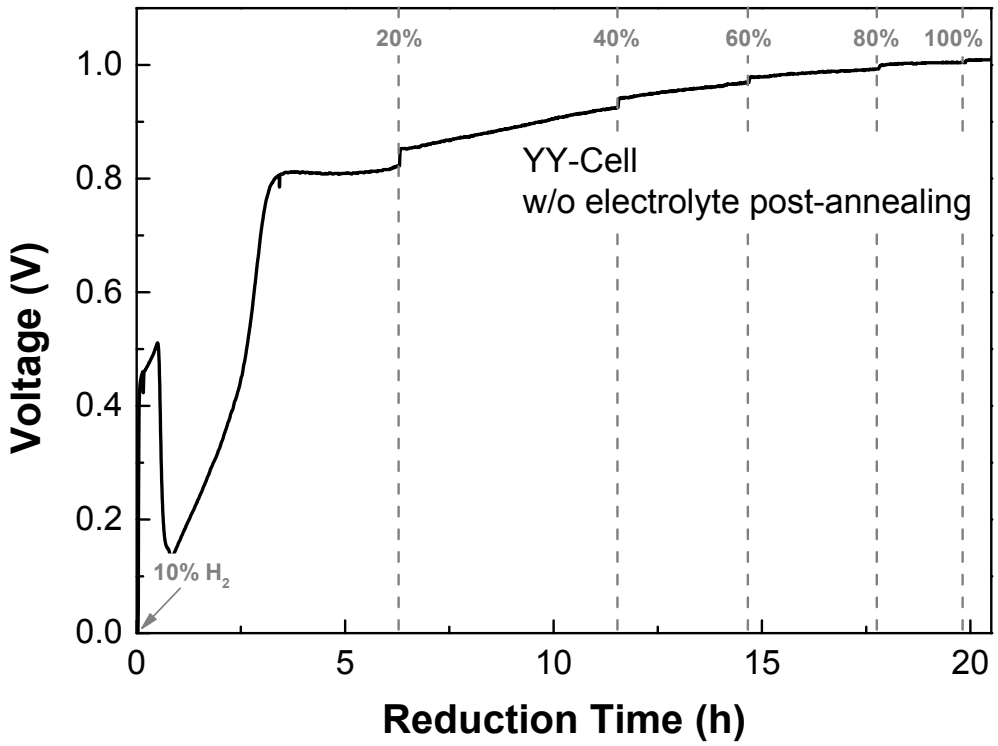

Fig. S6. Open circuit voltage profile of the YY-Cell, which is fabricated without electrolyte post-annealing, obtained via an anode reduction process at 600 °C.

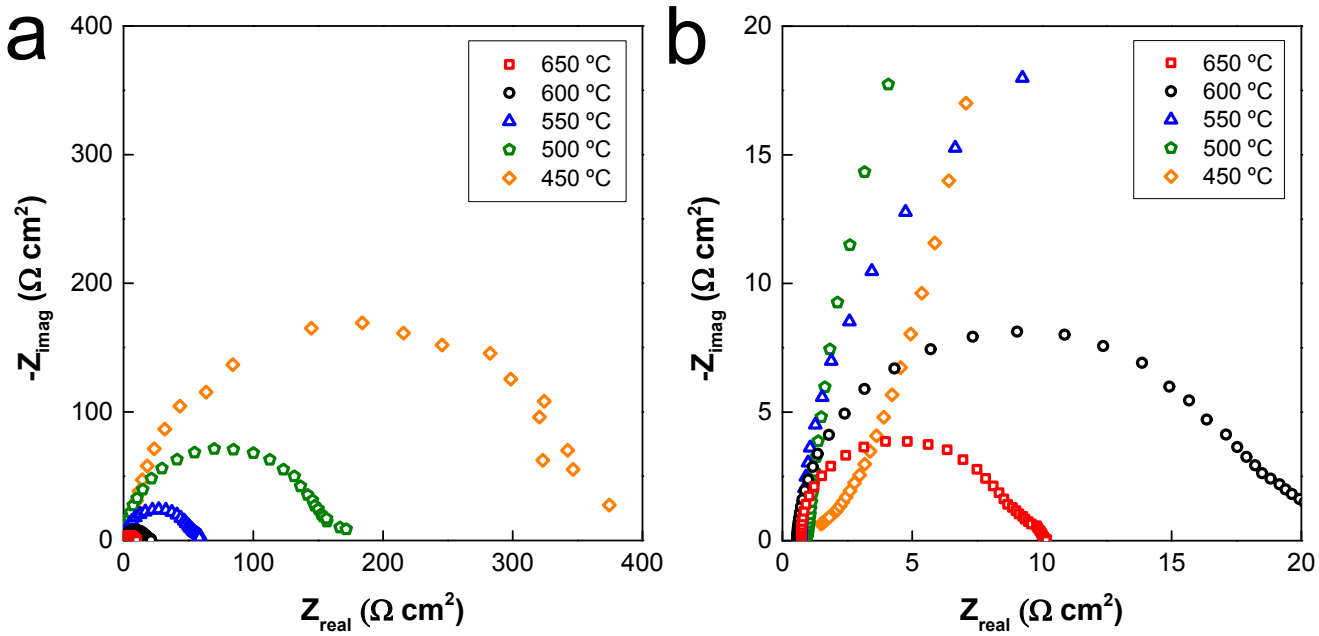

Fig. S7. Alternating current impedance spectra of the YY-Cell obtained under open circuit voltage condition and at operating temperatures of 450–650 °C.