Supplementary Materials

Tantalum doped $La_{0.6}Sr_{0.4}FeO_{3-\delta}$ electrodes for symmetrical proton conducting solid oxide fuel cell

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Experimental details

1. Cell fabrication

To produce the symmetrical cells, for LSFT|BZCYYb|LSFT, 0.8 g BZCYYb powder was initially uniaxially pressed into the circular pellet at 20 MPa, followed by firing up to 1450 ^{o}C and holding for 6 h to form the BZCYYb electrolyte with sufficient gas-tightness and mechanical strength. Then the LSFT cathode slurry was patched on the two sides of the BZCYYb electrolyte by brush-painting and the

LSFT|BZCYYb|LSFT symmetrical cell was fired at 1000 ^{o}C for 3 h. The effective areas of the LSFT electrodes are about 0.2 cm^2. The other symmetrical cell LSFN|BZCYYb|LSFN was prepared by using a similar process.

2. Characterization

Perkin-Elmer PHI 550 was used for the X-ray photoelectron spectroscopy (XPS) measurement. The Bruker D8 ADVANCE using Cu Kα radiation was applied to investigate the X-ray diffraction (XRD) patterns. Moreover, the XRD scanning angle is changed from 20 to 80^{o} and the interval is 0.02^{o}. The microstructure was revealed by the HITACHI SU8200 scanning electron microscope (SEM).

3. Electrochemical measurements

An electrochemical workstation performed the electrochemical measurement (Gamry interface 1010). Electrochemical impedance spectra (EIS) was acquired under open circuit voltage (OCV) condition with a 0.1 Hz to 1 MHz frequency range and a 50 mV amplitude. The voltage, power density versus current density curves of the cells were collected by a linear sweep mode, from OCV to 0.2 V. The corresponding current values at the different voltages were collected. The cell performance was studied in the temperature range from 500 to 800 ^{o}C, by feeding dry H_2 with a flow rate of 50 mL min^{-1} in the anode and synthetic air with a flow rate of 100 mL min^{-1} in the cathode.

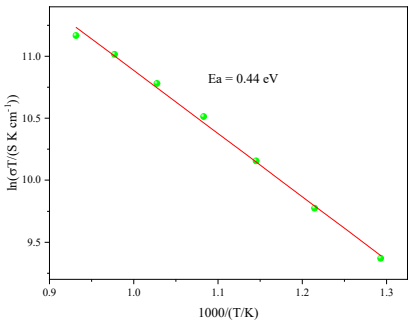

Fig. S1. The Arrhenius plots for σ of LSFT in air.

Table S1. The results of Rietveld refined XRD patterns for LSFT and LSFN.

Parameters	LSFT	LSFN
Space group	P n m a	P n m a
a	5.56926	5.53156
b	7.83270	7.83143
c	5.53974	5.53814
$\alpha = \beta = \gamma$	90	90
V	241.65644	239.91236

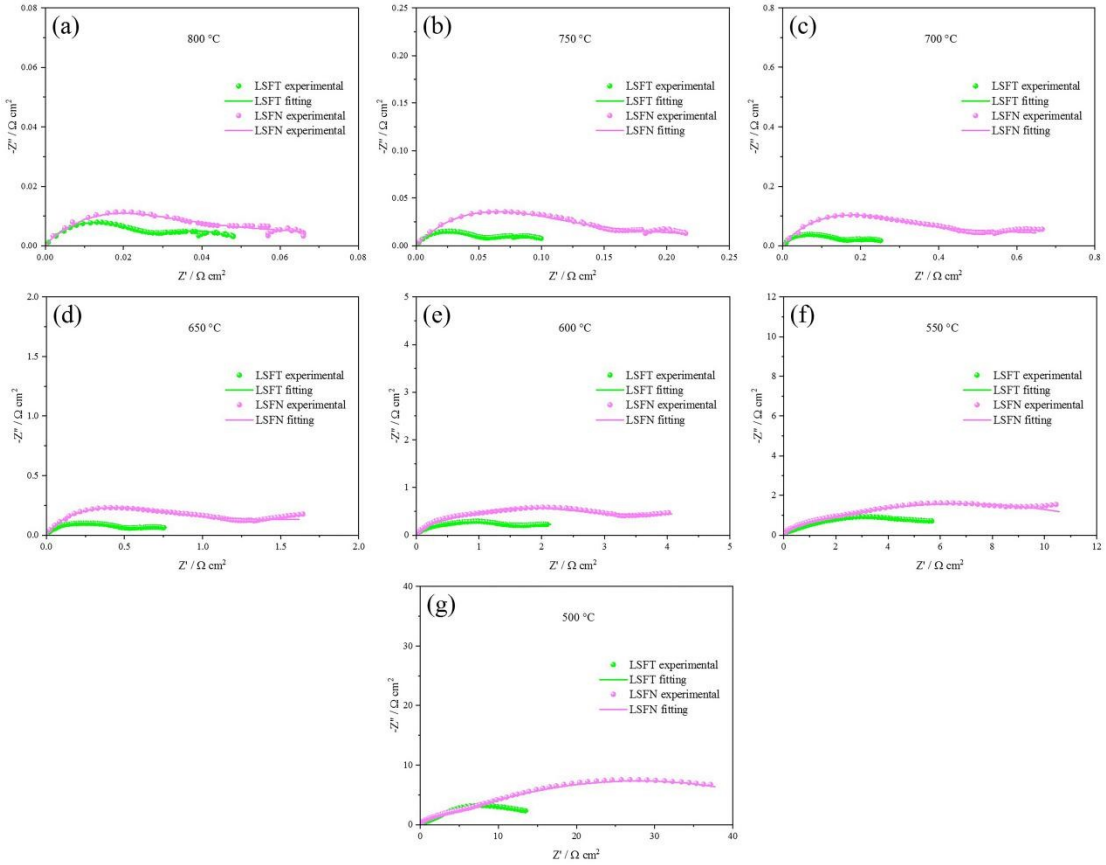

Fig. S2. EIS of the symmetrical cell LSFT|BZCYYb|LSFT and LSFN|BZCYYb|LSFN in air at (a) 800, (b) 750, (c) 700, (d) 650, (e) 600, (f) 550 and (g) 500 °C, respectively.

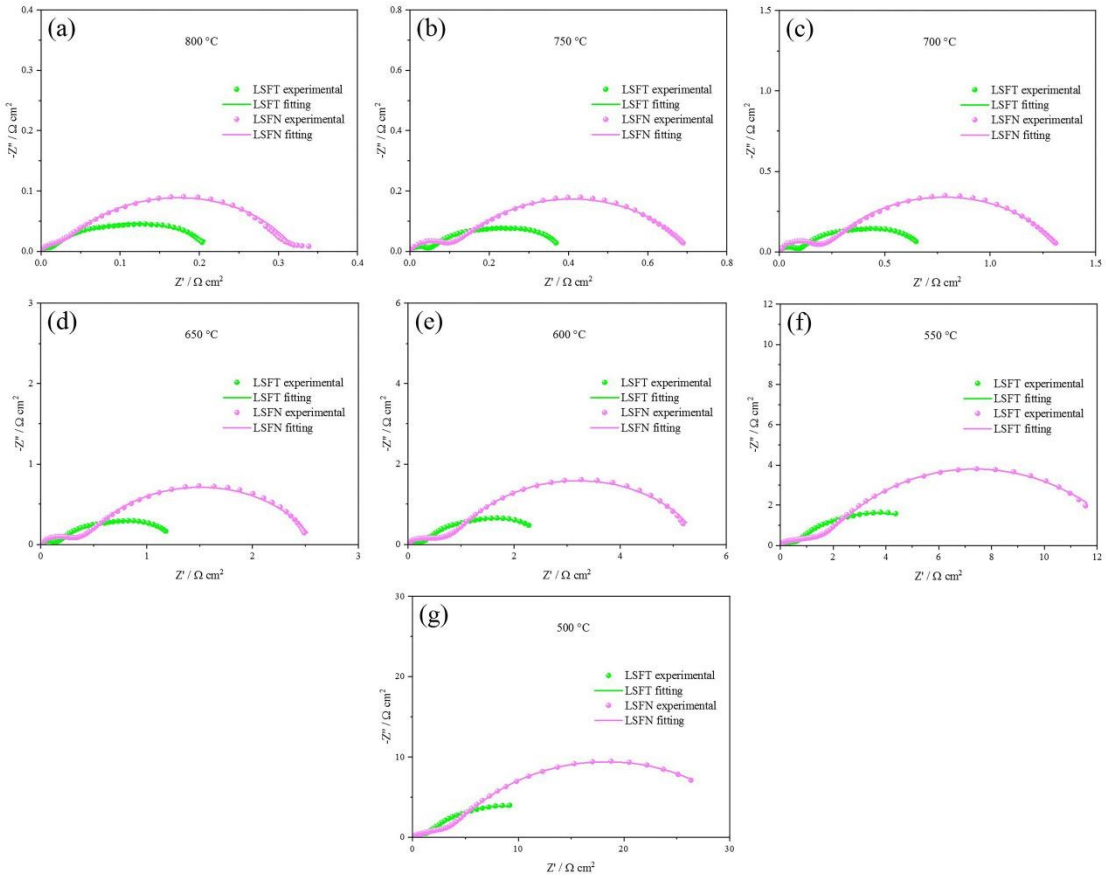

Fig. S3. EIS of the symmetrical cell LSFT|BZCYYb|LSFT and LSFN|BZCYYb|LSFN in H_2 at (a) 800, (b) 750, (c) 700, (d) 650, (e) 600, (f) 550 and (g) 500 °C, respectively.