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## **Supplementary Information**

## A Straight, Open and Macro-porous Fuel Electrode-supported Protonic Ceramic Electrochemical Cell

## Yuxin Pan<sup>1</sup>, Kai Pei<sup>1</sup>, Yucun Zhou<sup>2</sup>, Tong Liu<sup>3</sup>, Meilin Liu<sup>2</sup>, Yu Chen<sup>1\*</sup>

<sup>1</sup>School of Environment and Energy, South China University of Technology, Guangzhou, 510006, China

<sup>2</sup>School of Material Science and Engineering, Georgia Institute of Technology, Atlanta, GA 30309, US
<sup>3</sup>Key Laboratory of Hydraulic Machinery Transients, Ministry of Education, School of Power and Mechanical Engineering, Wuhan University, Wuhan, Hubei 430072, China

Corresponding Author: \* Yu Chen. E-mail: eschenyu@scut.edu.cn



Figure S1 SEM images of the substrate with a sponge layer (a) and a skin layer (b). Insets are the surface view of sponge layer and skin layer. Finger-like pores are covered by the two relative dense layers.



**Figure S2** (a) Typical I-V-P curves of DP cell tested at temperatures of 600, 650 and 700 °C, respectively; (b) Typical I-V-P curves of P cell tested at temperatures of 650 and 700 °C, respectively.



Figure S3 Electrochemical impedance spectra of three types of cells at temperatures of 600, 650 and 700 °C, respectively: (a) DP cell, (b) P cell and (c) MP cell.



Figure S4 SEM images of MP cell before long term testing: (a) air electrode, (b) fuel electrode; and SEM images of MP cell after long term testing: (c) air electrode, (d) fuel electrode. It demonstrates that our cells are structurally stable after long term testing.



Figure S5 Long term stability test of MP cell in fuel cell mode at a current density of -0.5 A cm<sup>-2</sup> at 650 °C. The cell was tested using 3%  $H_2O$  humidified hydrogen in fuel electrode and ambient air in air electrode. The sudden decline in the beginning may be related to the disturbance of gas flow.