Electronic Supplementary Material (ESI) for Sustainable Energy & Fuels.

Temperature Gradient Reduction in a Tubular Direct Ammonia Solid Oxide Fuel Cell by Fluidizing the Cathode Particles

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Supporting materials

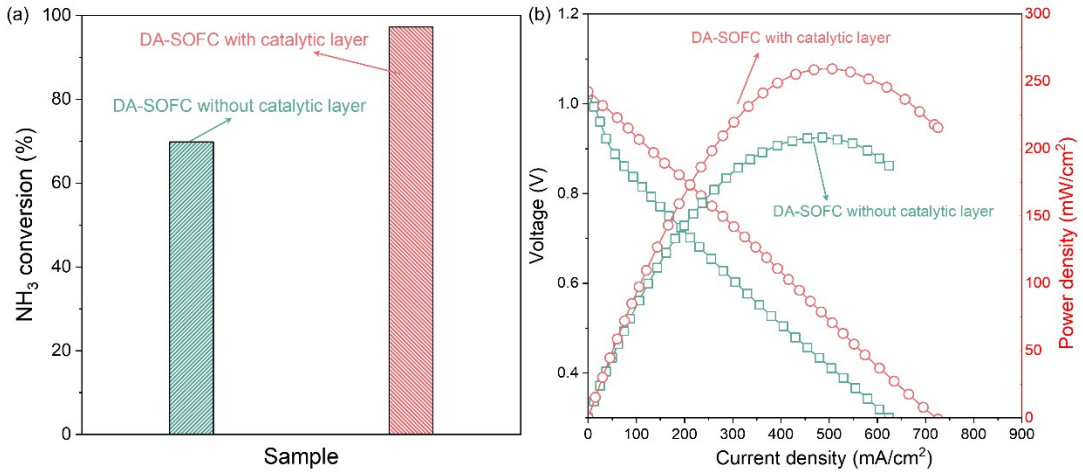

Fig. S1. (a) NH_3 decomposition and (b) *I-V-P* profiles of DA-SOFC with and without catalytic layer.

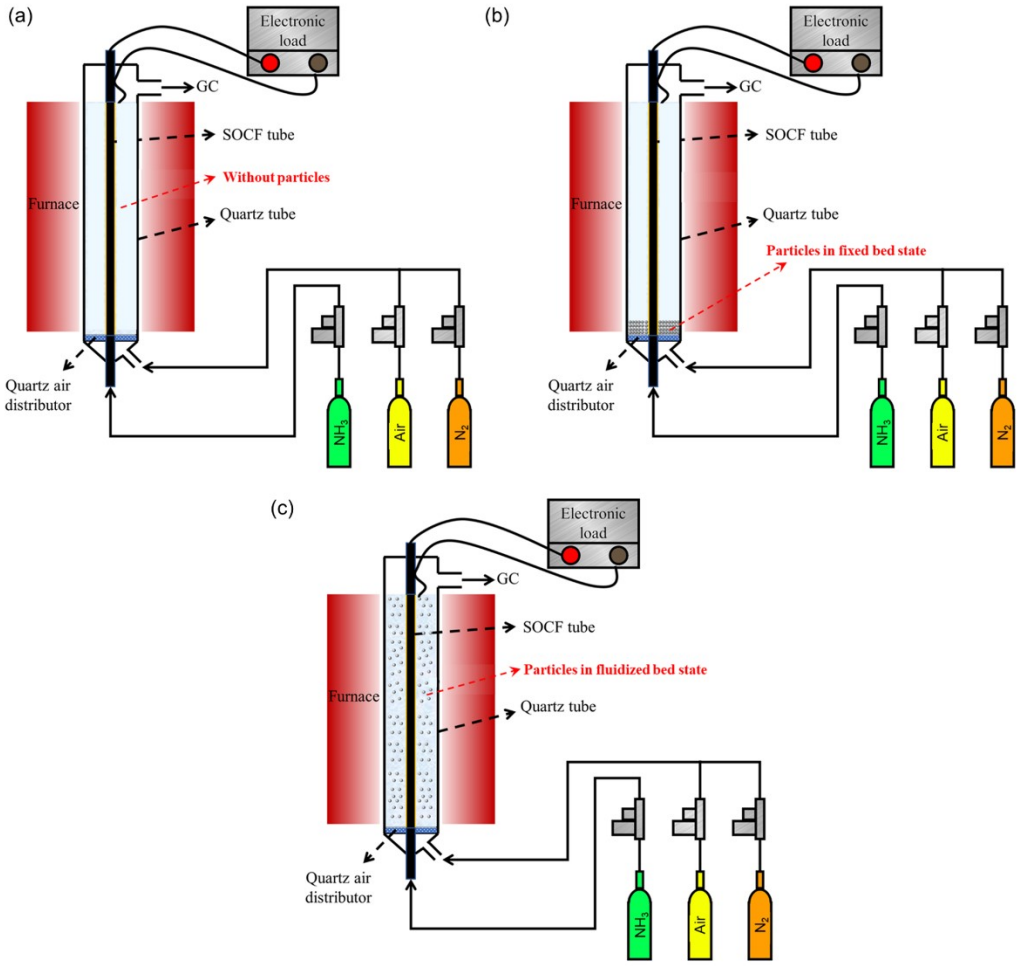

Fig. S2. Schematic illustration of the three configurations. (a) DA-SOFC/N, (b) DA-SOFC/FB, and (c) DA-SOFC/FL

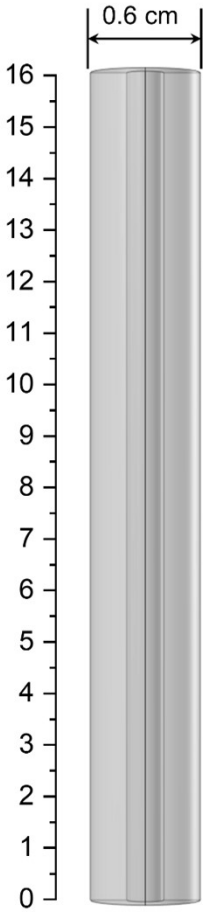

Fig. S3. Schematic of the numerical model.

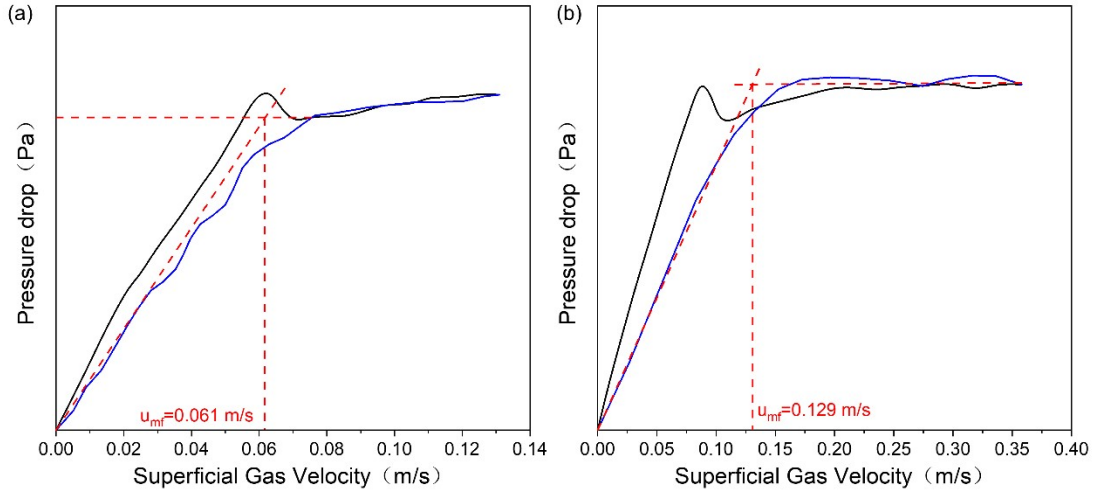

Fig. S4. Pressure drops versus superficial velocity for the particles with the size of (a) 242 μm and (b) 350 μm to determine the critical fluidized velocity (u_{mf}).

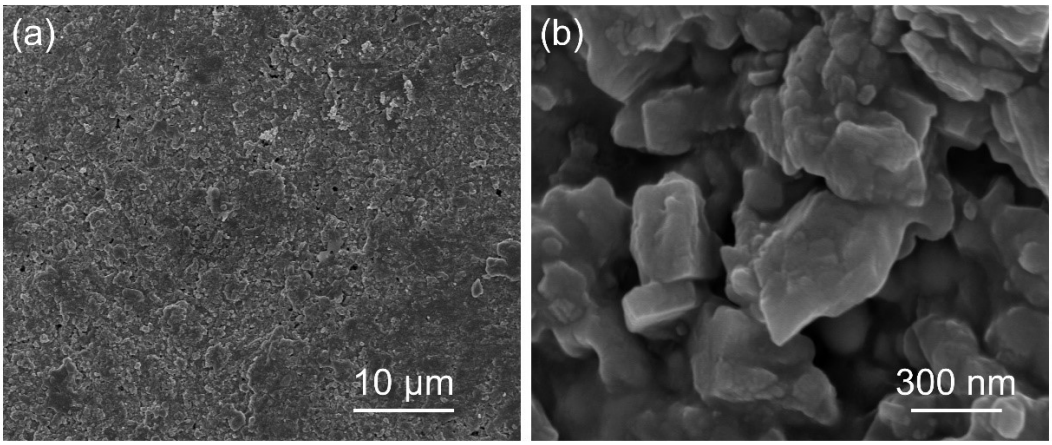

Fig. S5. SEM images of the cathode layer for DA-SOFC/FL after 200 hours

Table S1. Configuration of the tubular SOFC

Layers	Composition	Thickness (μm)	Diameter (mm)	Elastic modulus (GPa)	Thermal expansion coefficient (/^{o}C)
Anode	Ni/YSZ	620	6	200	$11.5*10^{-6}$
Electrolyte	YSZ	5.91	6	200	$10.0*10^{-6}$
Cathode	LSCF/YSZ	8.38	6	95	$17.0*10^{-6}$

Table S2. Parameters of the DA-SOFC used in the modelling

Parameter	Dimension
Inner diameter	6 mm
Anode thickness	620 μm
Electrolyte thickness	5.9 μm
Cathode thickness	8.4 μm
Cell length	16 cm
Anode permeability	1e-10 m^2
Cathode permeability	1e-10 m^2
Temperature	750 ^oC
Anode thermal conductivity	11 (W/m/K)
Electrolyte thermal conductivity	2.7 (W/m/K)
Cathode thermal conductivity	6 (W/m/K)
Anode specific heat	450 (J/kg/K)
Electrolyte specific heat	470 (J/kg/K)
Cathode specific heat	430 (J/kg/K)
Porosity	0.35
Anode inlet composition	Pure Ammonia
Anode inlet composition	Air
Reference diffusivity	3.16e-8 m^2/s