Supporting Information for

Gas leak diffusion induced polarization in submicro/nanoscale non-tight electrolytes of solid oxide fuel cells

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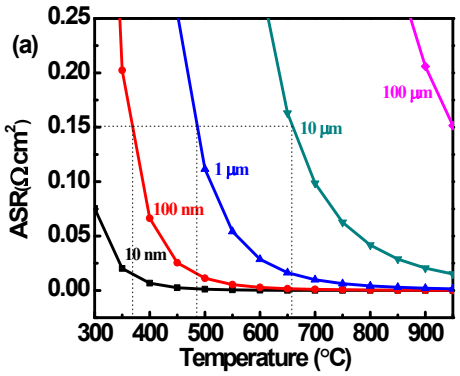

Fig. S1 Area-specific residence (ASR) of YSZ electrolyte as a function of temperature. The ionic conductivity of YSZ is adopted from Ref. [1]. The data for YSZ electrolyte with a thickness of 100 μm, 10 μm, 1 μm, 100 nm and 10 nm are given. To ensure ASR < 0.15 Ω·cm², as indicated by the dash line, an operating temperature > 900 ℃, > 660 ℃, > 490 ℃ and > 370 ℃ is required for YSZ of 100 μm, 10 μm, 1 μm and 100 nm thicknesses, respectively.

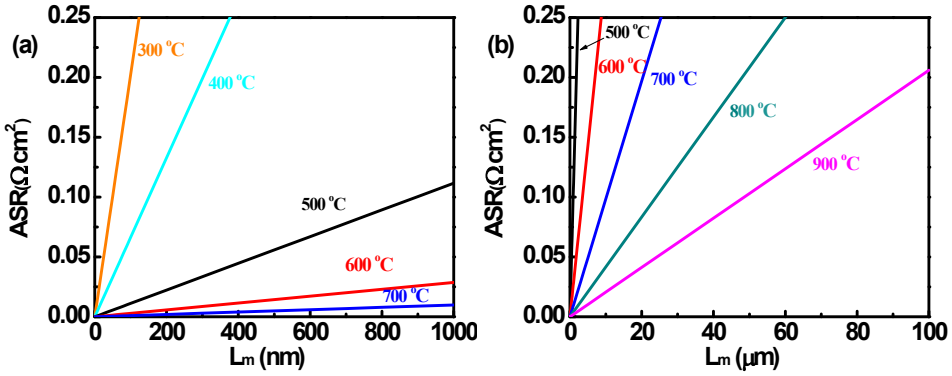

Fig. S2 ASR as a function of YSZ thickness in the range of (a) 0~1000 nm and (b) 0~100 μm, at different

temperatures. To ensure ASR < 0.15 Ω·cm^2 and μSOFCs operate below 400 ℃, the thickness of YSZ should be decreased to < 200 nm.

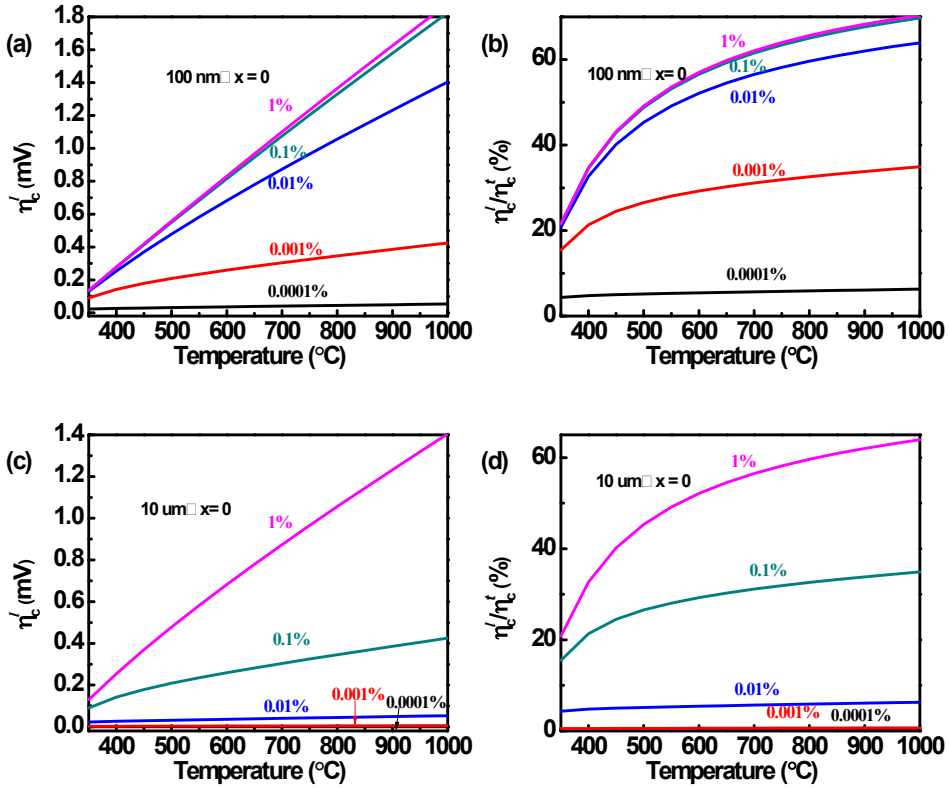

Fig. S3 Electrolyte leak gas diffusion induced cathode concentration polarization as a function of temperature when the electrolyte thickness is (a-b) 100 nm and (c-d) 10 μm, respectively. (a) and (c) show η_c^l *versus T*. (b) and (d) show the proportion of η_c^l to the total cathode polarization *versus T*. In the calculations, SOFCs operate at an output current density of 0.1 A/cm^2. It is assumed that the leaked H_2 and O_2 do not react directly (x = 0).

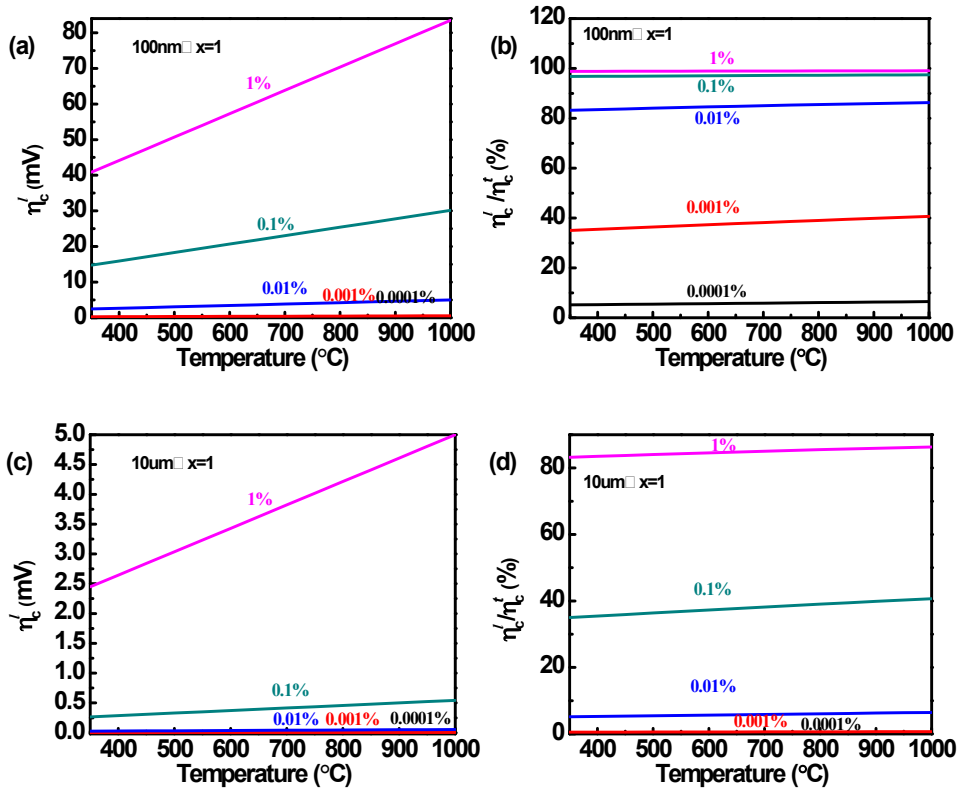

Fig. S4 Electrolyte leak gas diffusion induced cathode concentration polarization as a function of temperature when the electrolyte thickness is (a-b) 100 nm and (c-d) 10 μm, respectively. (a) and (c) show the η_c^l *versus T*. (b) and (d) show the proportion of η_c^l to the total cathode polarization *versus T*. In the calculations, SOFCs operate at an output current density of 0.1 A/cm^2. It is assumed that the leaked H_2 and O_2 react completely (x = 1).

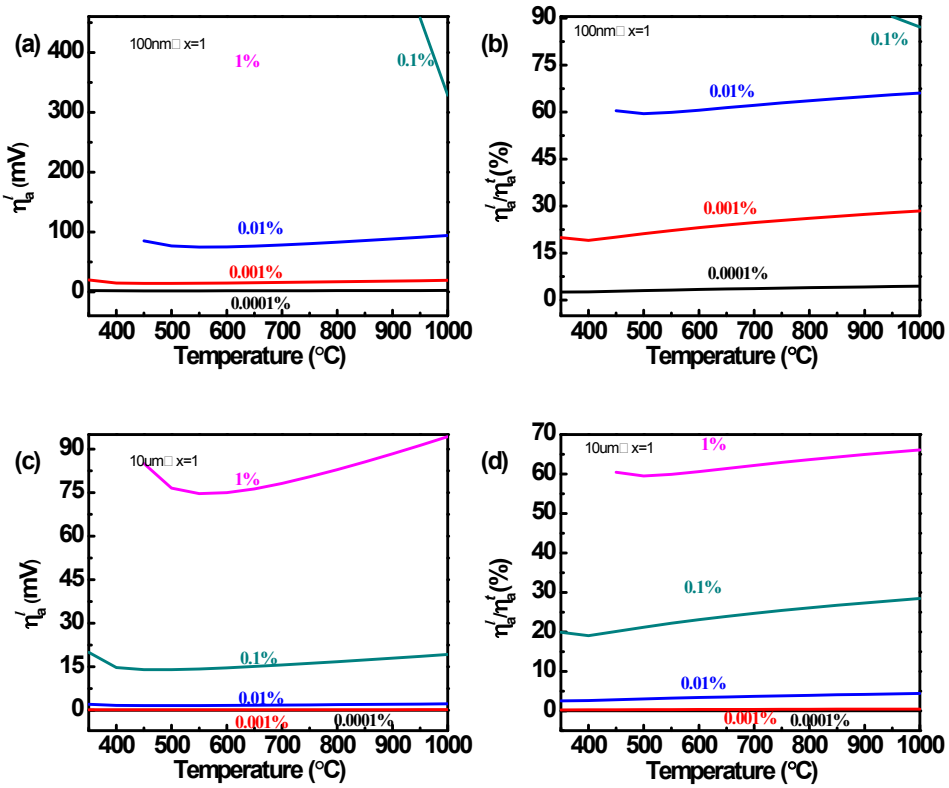

Fig. S5 Electrolyte leak gas diffusion induced anode concentration polarization as a function of temperature when the electrolyte thickness is (a-b) 100 nm and (c-d) 10 μm, respectively. (a) and (c) show the η_a^l *versus T*. (b) and (d) show the proportion of η_a^l to the total cathode polarization *versus T*. In the calculations, SOFCs operate at an output current density of 0.1 A/cm^2. It is assumed that the leaked H_2 and O_2 react completely (x = 1).

References

1. B.C.H. Steele, A. Heinzel, Nature, 2001, 414(6861): 345-352.