

Electronic supplementary information

for

Enhanced PEMFC performance through high O₂ permeation and proton conductivity electrospun nanofiber electrodes with unique ionomer construction

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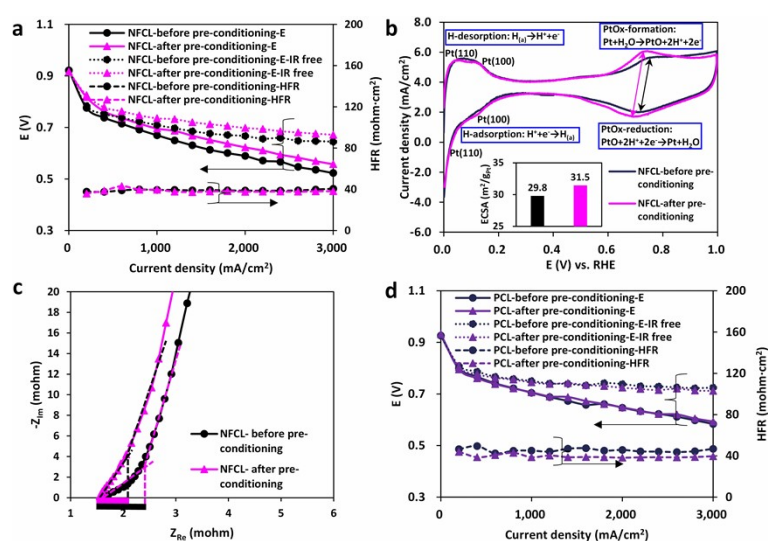


Fig. S1. H₂/air fuel cell polarization data (a), CV results (b) and EIS (c) in H₂/N₂ at 0.45 V with a 10-mV amplitude for 25 cm² NFCL electrodes at 80 °C and 100% RH of cathode and anode, respectively; (d) H₂/air fuel cell polarization data for 25 cm² PCL electrodes at 80 °C and 100% RH of cathode and anode. The formation and reduction of PtO_x is presented figuratively by the reactions including PtO; however, further oxide species such as PtOH or PtO₂ are present depending on the upper potential sweep limit and catalyst material. The insert in (b) is the ECSA of NFCL before and after pre-conditioning process. The Pt loadings of cathode and anode in this figure are 0.15 and 0.05 mg_{Pt}/cm², respectively.

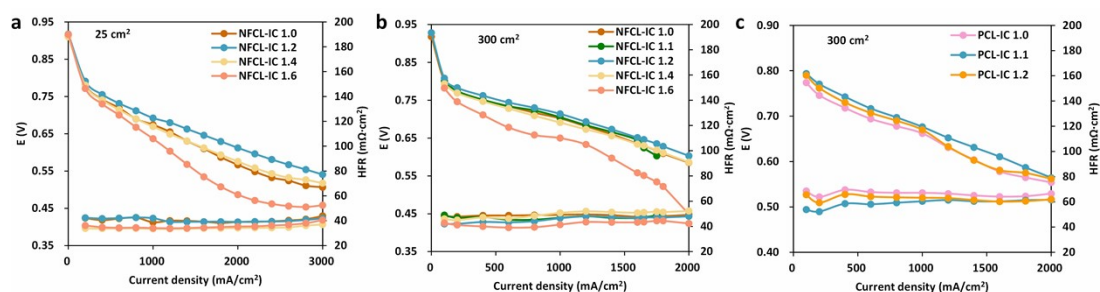


Fig. S2. (a) H₂/air fuel cell performance comparison of 25 cm² NFCL electrode with various IC ratios after pre-conditioning method at 100% RH and 80 °C. H₂/air fuel cell performance comparison of 300 cm² NFCL electrode after pre-conditioning method (b) and 300 cm² PCL electrode (c) with various IC ratios at 90 °C and 0% RH of cathode and 40% RH of anode. The Pt loadings of cathode and anode in (a-c) are 0.15 and 0.05 mg_{Pt}/cm², respectively.

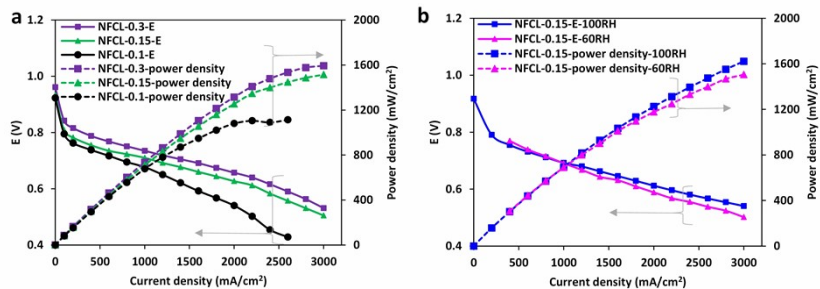


Fig. S3. (a) H₂/air fuel cell polarization and power density data for 300 cm² NFCL electrode after pre-conditioning method at 0% RH of cathode and 40% RH of anode with cathode loading 0.1, 0.15 and 0.3 mg_{Pt}/cm². (b) H₂/air fuel cell polarization and power density data for 25 cm² NFCL electrode after pre-conditioning method at 100% RH and 60% RH with cathode loading 0.15 mg_{Pt}/cm². The Pt loadings of anode in (a) and (b) are 0.05 mg_{Pt}/cm².

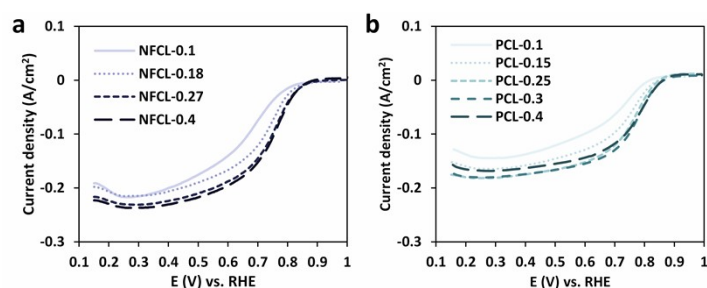


Fig. S4. LSV curves of limiting current density measurement in 1% O₂ in N₂ balance gases, at 80 °C, 150 kPa_{abs}, and 90% RH with different Pt loadings of 2 cm² PCL and NFCL electrodes.

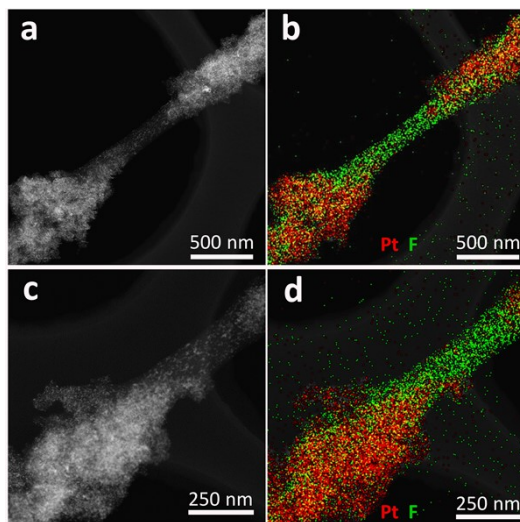


Fig. S5. STEM DF image showing nanofiber morphology (a, c). Overlays of DF image and EDS map of Pt-red, F-green (b, d). These images show the fiber positions connected by ionomer fibers in NFCL.

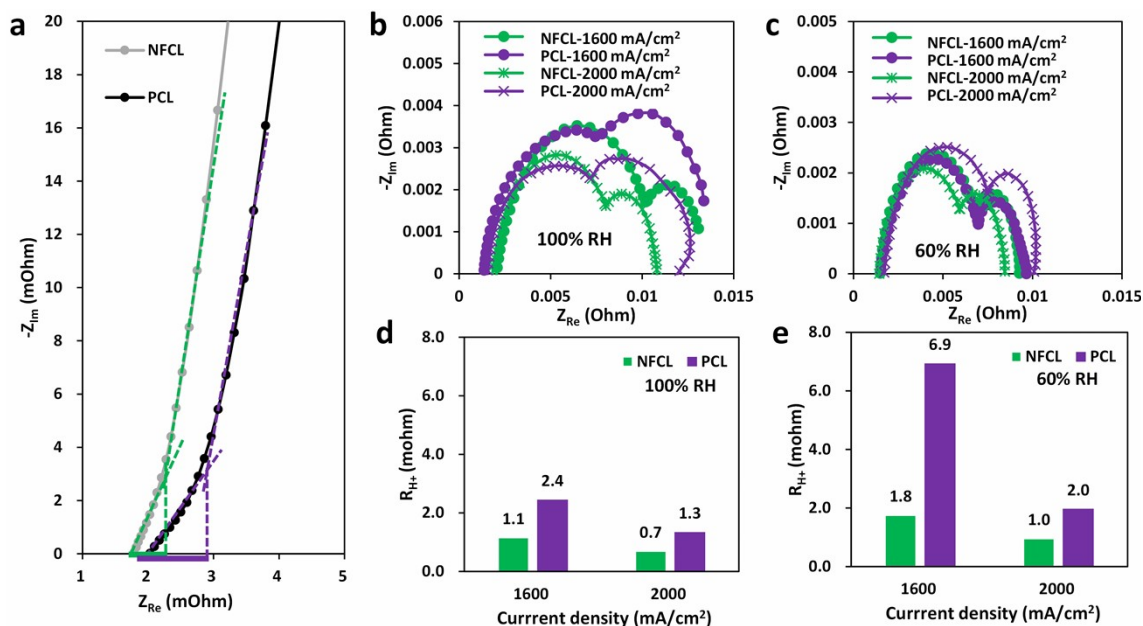


Fig. S6. (a) EIS of a 25 cm² MEAs with PCL and NFCL cathode in H₂/N₂ at 0.45 V with a 10-mV amplitude, ex-situ proton transfer resistance, R_{H+} obtained from the green and purple solid lines. Nyquist plots at 1600 and 2000 mA/cm² of 25 cm² PCL and NFCL electrodes in H₂/Air with 100% RH (b) and 60% RH (c), respectively. In-situ R_{H+} at 1600 and 2000 mA/cm² of PCL and NFCL electrodes obtained from EIS in H₂/Air with 100% RH (d) and 60% RH (e), respectively. The Pt loadings of cathode and anode are 0.15 and 0.05 mg_{Pt}/cm², respectively.

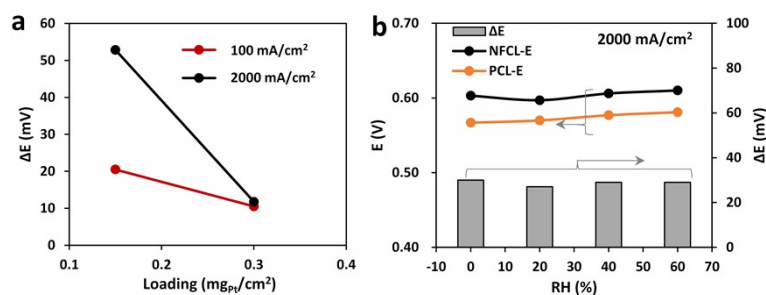


Fig. S7. (a) The voltage difference between NFCL and PCL electrodes at 100 and 2000 mA/cm² vs. two Pt loadings in 0% RH cathode. (b) The voltage of NFCL and PCL electrodes and the voltage difference between NFCL and PCL electrodes at 2000 mA/cm² vs. various RH. The anode Pt loading is 0.05 mg_{Pt}/cm², and the reactive area is 300 cm².