Electronic Supplementary Information

Performance and DRT analysis of P-SOFCs fabricated using new phase inversion combined tape casting technology

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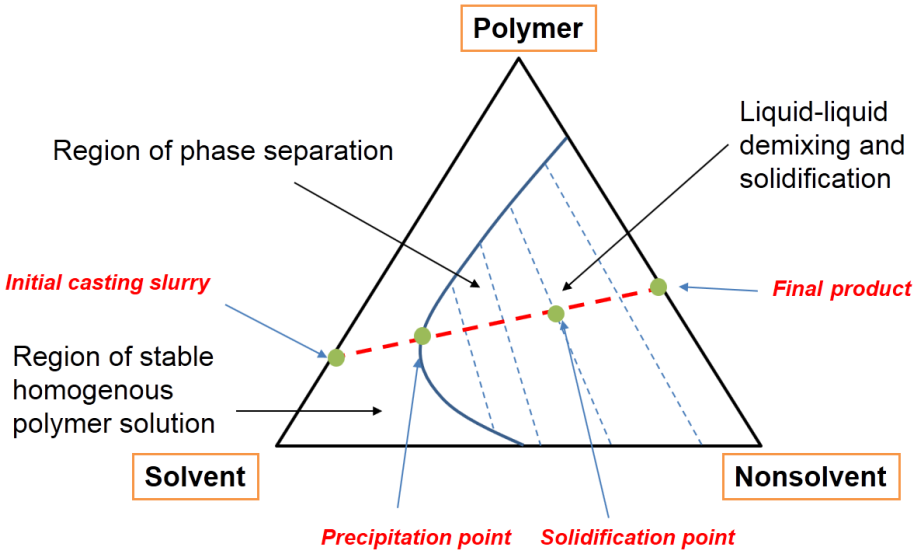


Fig.S1 Polymer-solvent-nonsolvent ternary phase diagram.

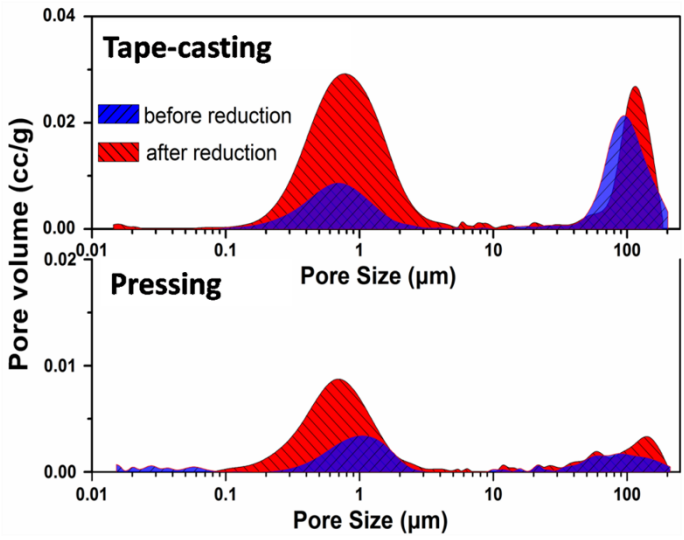


Fig.S2 Pore size distribution of anode substrates before and after reduction in hydrogen at 750°Cfor 5 hours.

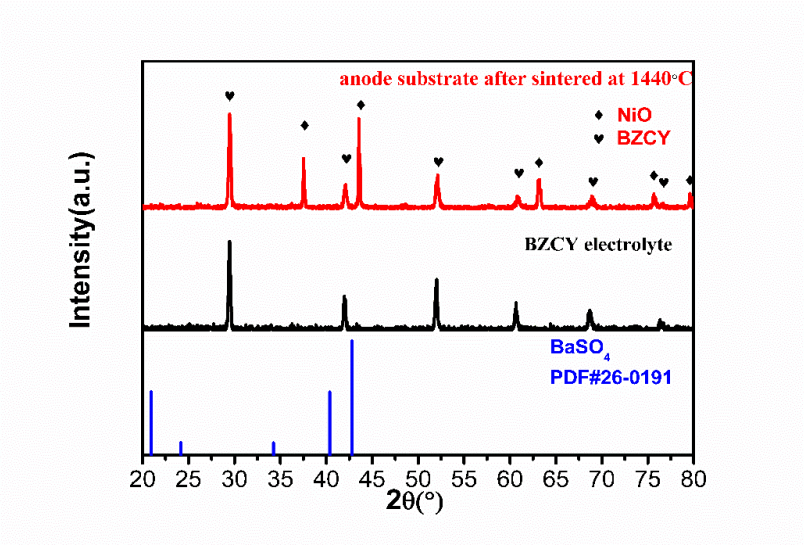
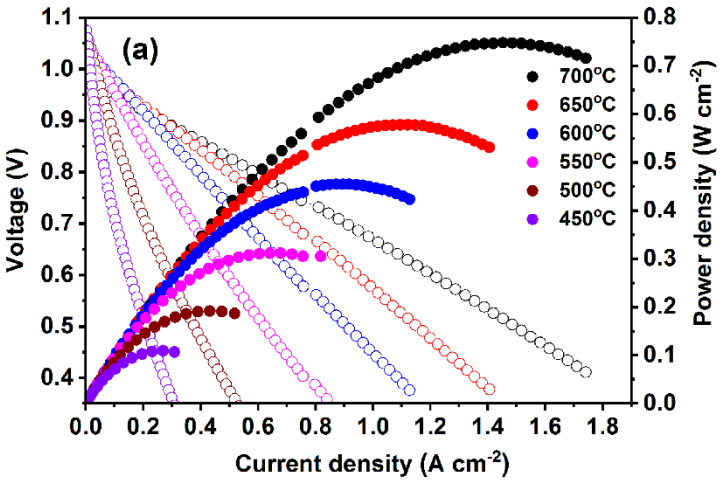


Fig.S3XRD patterns of Ni-BZCY anode substrate and BZCY electrolyte film co-sintered at 1440 ℃ for 5 h. Standard XRD pattern for $BaSO_4$is also shown for comparison.



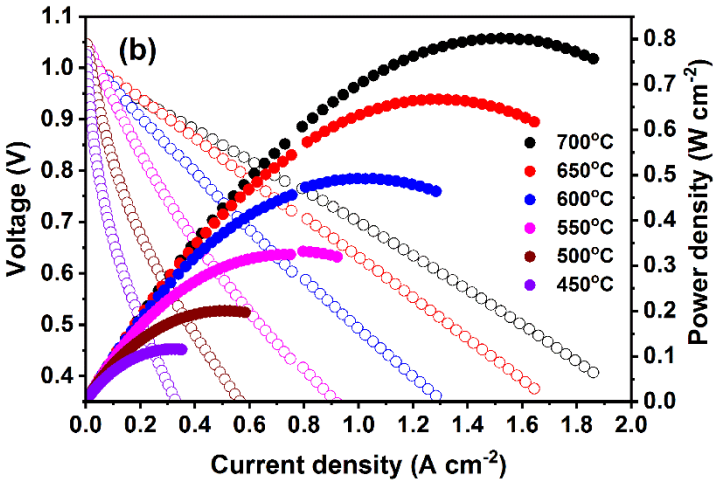


Fig.S4I-V and I-P curves of (a)PICTC button cell and (b) cold-pressing cell fueled with humid H_2

Table.S1Summary of performance (fueled with humid hydrogen) with protonic ceramic electrolytesreported in the literature.

BZCY17 ($BaZr_{0.1}Ce_{0.7}Y_{0.2}O_3$), BZFCY0.1($BaCo_{0.4}Fe_{0.4}Zr_{0.1}Y_{0.1}O_3$), BZCY35 ($BaZr_{0.3}Ce_{0.5}Y_{0.2}O_3$)

Anode	**Cathode**	**Electrolyte**	**Electrolyte thickness**	**P_{max}**($mWcm^{-2}$)	**R_p**(Ωcm^2)	**Ref.**
BZCY17-NiO Dry pressing	BZCY17-SSC (Suspension spray)	BZCY17 Suspension coating		350(600°C)	0.35	[1]
BZCY17-NiO Dry pressing	BZCY17-SSC (Slurry painting)	BZCY17 Modified co-pressing	65μm	445(600°C)		[2]
BZCY17-NiO Dry pressing	BZCY17-LSF (Slurry painting with SSC impregnation)	BZCY17 Dry pressing		140(600°C)	1.12	[3]
BZCY17-NiO Dry pressing	BZCY17-BSCF (Slurry painting)	BZCY17 Dry pressing	20μm	267(600°C)	0.6	[4]
BZCY17-NiO Dry pressing	BZCY17-LSCF (Slurry painting)	BZCY17 Dry pressing	55μm	205(550°C)	1.34	[5]
BZCYYb-NiO Dry pressing	BCZYYb-BCFZY0.1 (BCFZY0.1 impregnation)	BZCYYb Screen-printing	30μm	455(500°C)	0.26	[6]
BZCY35-NiO	Sr3Fe2O7-BZCY35 (Slurry painting)	BZCY35 Dry pressing	14μm	372(600°C)	0.35	[7]
BZCY35-NiO phase-inversion tape casting	BZCY35-LSCF (Slurry painting)	BZCY35 Suspension coating	14μm	455(600°C) 312(550°C) 192(500°C)	0.18 0.45 1.40	This work

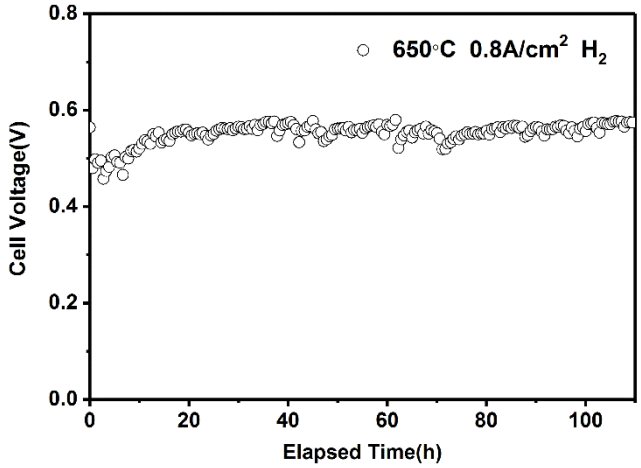


Fig.S5Long-term characterization of PICTC cell fueled with humid H_2

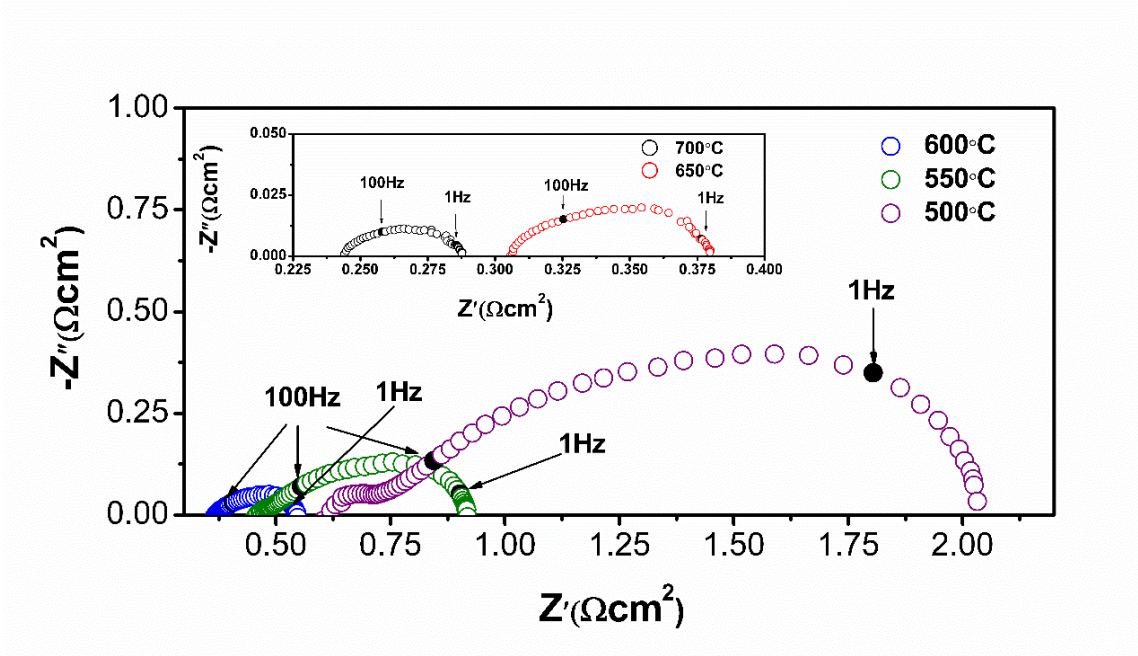


Fig.S6 Impedance spectra of the single cell when tested in humid H_2 from 500℃ to 700℃

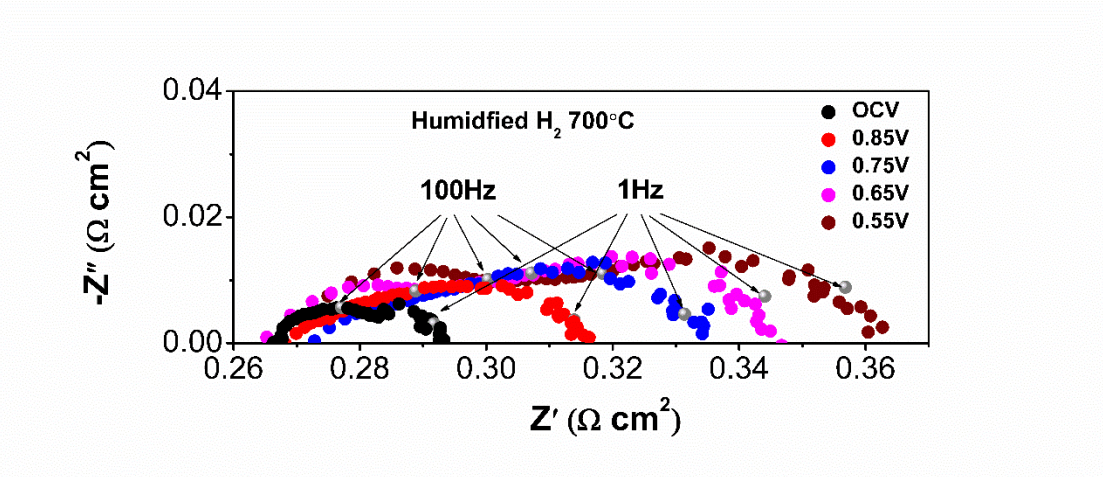


Fig.S7.Impedance spectra of the PICTC cell operating at different voltageswith humid H_2 as fuel measured at 700°C.

Table.S2.Total resistances calculated from impedance spectra (R_{imp}) and simulated from I-V curves (R_{I-V}) for PICTC cell and cold-pressing cell fueled with CH_3OH-N_2 and H_2, respectively, measured at 700 °C

	H_2		**CH_3OH-N_2**	
Sample	$R_{imp}(\Omega cm^2)$	$R_{I-V}(\Omega cm^2)$	$R_{imp}(\Omega cm^2)$	$R_{I-V}(\Omega cm^2)$
PICTC cell	0.288	0.325	0.365	0.447
Cold-pressing cell	0.262	0.315	0.393	0.606

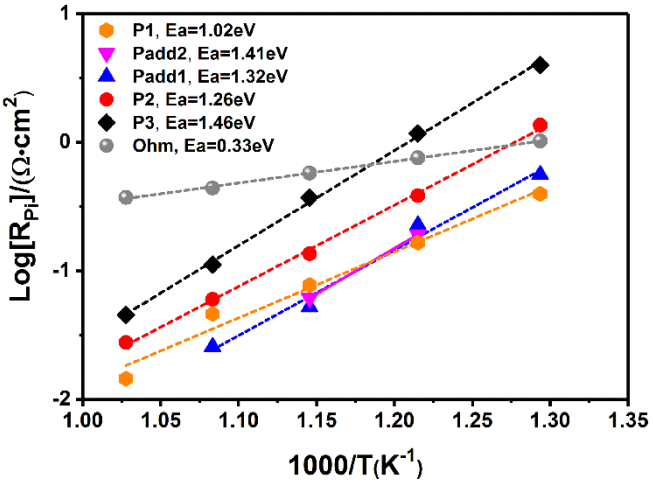
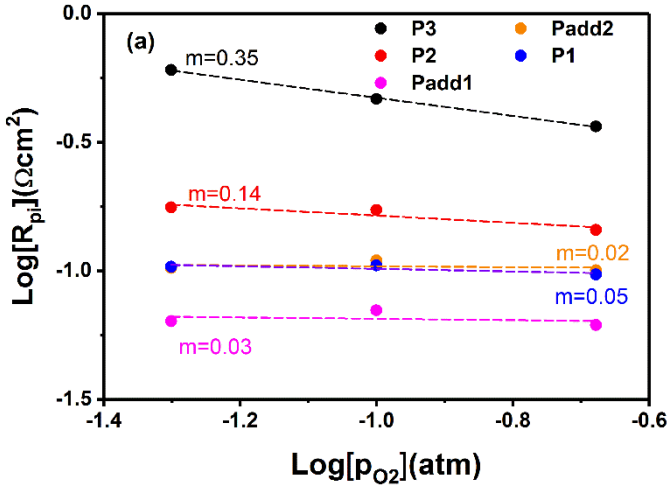


Fig.S8Temperature dependence of R_{pi}simulated from impedance spectra of PICTC cell



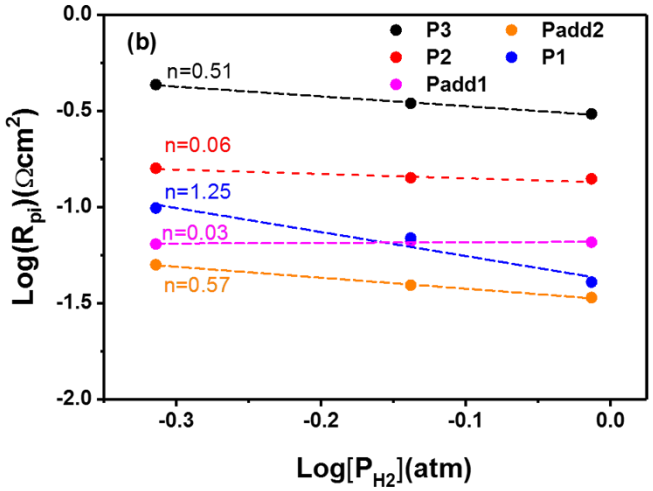


Fig.S9.Oxygenpartial pressure (a) and hydrogen partial pressure (b)dependences of the simulated resistances corresponding to each peak (Pi) measured at 600 °C

Reference

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