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Supplementary information

Swelling-Resistant, Crosslinked Polyvinyl Alcohol Membranes with High ZIF-8 Nanofiller Loadings as Effective Solid Electrolytes for Alkaline Fuel Cells

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Table S1. Comparison of acid and alkaline-based PVA composite electrolytes for direct methanol fuel cells. .

Electrolyte types	Membranes	Filler loading (wt%)	MeOH Con. (M)	Catalyst load (mg cm^{-2})		Temperature (°C)	Peak power density (Pmax) mW cm^{-2}	Source
				Anode (Pt-Ru)	Cathode (Pt)			
Acid-doped	CBA/Nafion-PVA	-	2	4	4	80	68.7	Li et al. [1] (2018)
	PVA/alumina	20	1	2	2	60	6.3	Imaan et al. [2] (2021)
	PVA/SSA-GO	1	1	3	1	50	19.5	Castell et al. [3] (2020)
	PVA coated Nafion	-	7	3.5	3.5	25	30	Rao et al. [4] (2021)
Without KOH	PVA/AA-TiO_2/GA	3	2	2	2	70	58.3	Mohanapriya et al. [5] (2016)
	CBC/PVA/zeolite	10	0.74	30wt%[a]	20wt%[a]	80	6.5	Altaf et al. [6] (2020)
	CBC/PVA/zeolite	50	0.74	30wt%[a]	20wt%[a]	80	4.8	Altaf et al. [6] (2020)

KOH-doped	Qchitosan-PVA/LDH @CNT	1	2 (5 M KOH)	4	2	80	107	Gong et al. [7] (2019)
	Qchitosan-PVA/LDH	5	2 (6 M KOH)	4	2	60	97.8	Hu et al. [8] (2019)
	Qchitosan-PVA/3D-LDH	6	2 (5 M KOH)	4	2	60	73	Zhao et al. [9] (2021)
	PVA/HH/GA	5	3 (2 M KOH)	2	2	60	12.1	Gaur et al. [10] (2021)
	PVA-FP/[DimL]/GA	2.5	3 (5 M KOH)	0.5	0.5	70	48	Wang et al. [11] (2019)
	PVA/40.5% ZIF-8/GA	40.5	2 (6 M KOH)	2	1	60	191	This work

[a] Data shown in weight percentage. Catalyst loadings is not determine.
CBA- 4-carboxybenzaldehyde
AA-TiO_2- Amino acid functionalized titanium oxide
Qchitosan - Quaternized chitosan
LDH@CNT- Layered double hydroxide@ carbon nanotubes
3D-LDH- Three-dimensional hierarchial flower-like LDH
HH- Hair hydrolysate
FP/[DimL]- Pyridine functionalized geminal-imidazolium-type ionic liquid
CBC- N-p-carboxy benzyl chitosan
PVA-b-PVBTAC- Poly (vinyl alcohol-b-vinyl benzene trimethyl ammonium chloride)

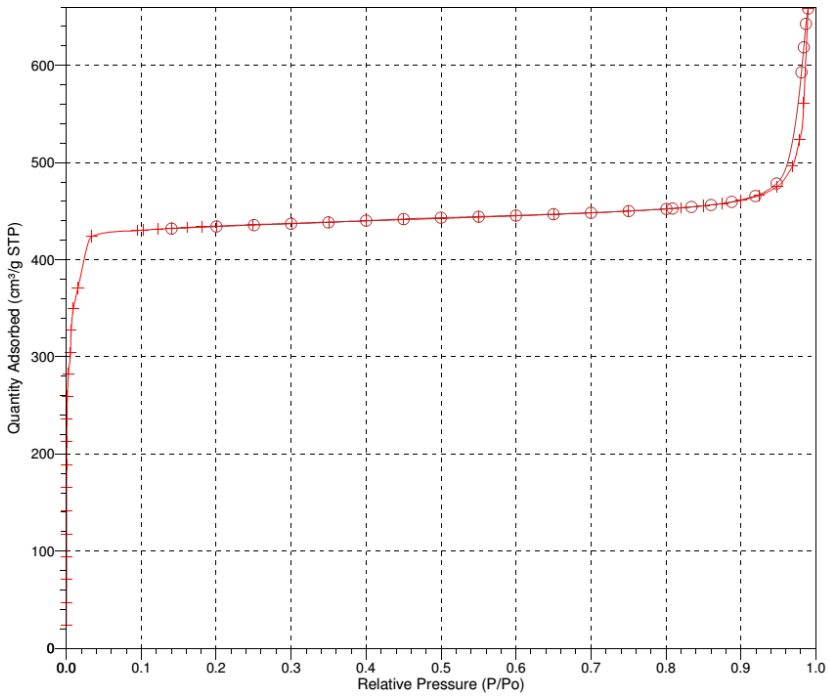

Figure S1. Nitrogen adsorption-desorption isotherm of ZIF-8 nanoparticles.

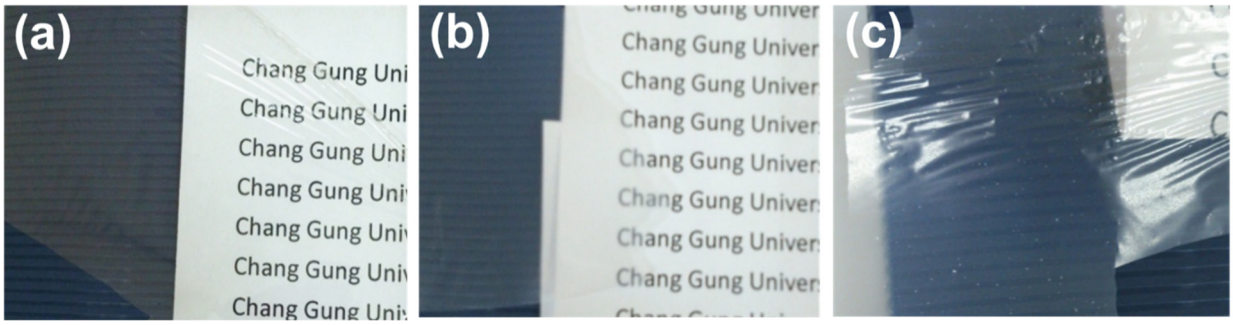

Figure S2. Photographic images of (a) PVA/GA, (b) PVA/40.5%ZIF-8/GA, and (c) PVA/45.4%ZIF-8/GA composite membranes.

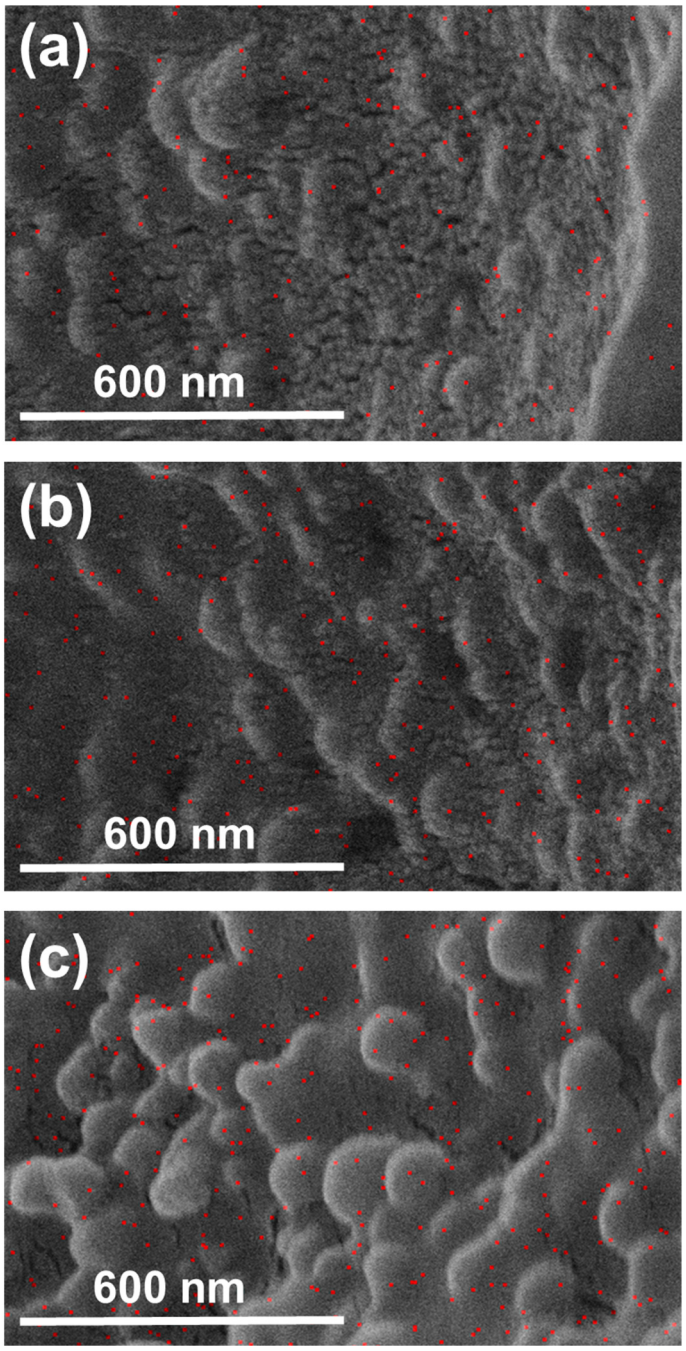

Figure S3. EDX mapping micrographs showing Zn distribution in (a) PVA/25.4%ZIF-8/GA, (b) PVA/40.5%ZIF-8/GA, and (c) PVA/45.4%ZIF-8/GA composite membranes.

Table S2. The weight percentages (determined from EDS) of PVA/ZIF-8/GA composites with various ZIF-8 loadings.

ZIF loadings	**0%**	**25%**	**40.5%**	**45.4%**
Element	**Wt (%)**	**Wt (%)**	**Wt (%)**	**Wt (%)**
C	72.47	76.96	68.46	68.21
O	27.53	14.48	18.04	16.27
Zn	-	8.56	13.50	15.52

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