Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

Supporting Information

Highly Hydrogen Permselective ZIF-8 Membranes Supported on Polydopamine Functionalized Macroporous Stainless-Steel-Nets

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Figure S1

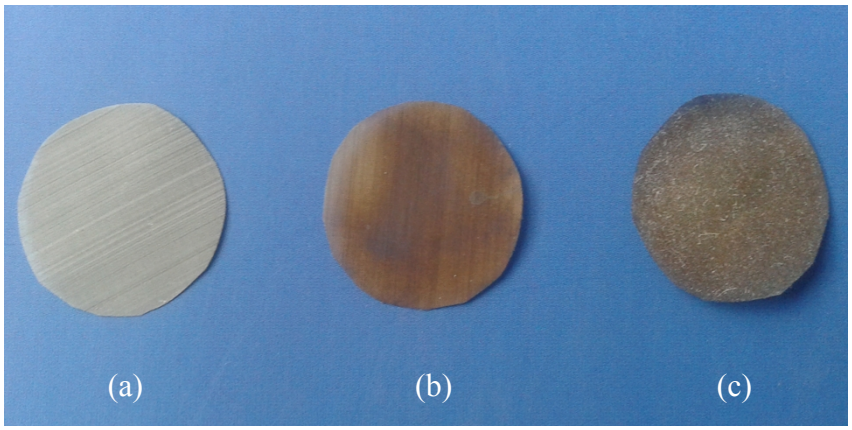

Figure S1. Photography of the SSN wafer (a), PDA-functionalized SSN wafer (b), and ZIF-8 membrane supported on PDA-functionalized SSN wafer (c).

Figure S2

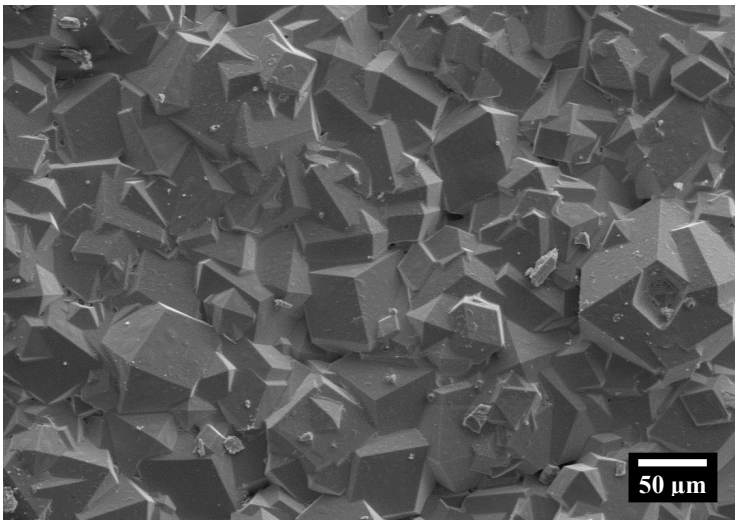

Figure S2. FESEM image of the ZIF-8 membrane layer prepared on PDA-functionalized SSN after 10 minutes ultrasonic treatment.

Figure S3

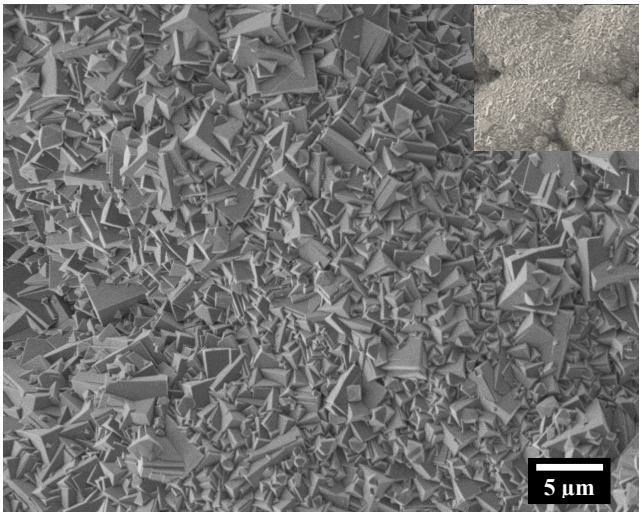

Figure S3. Top view FESEM image of the zeolite LTA membrane supported on PDA-functionalized SSN prepared at 60 °C for 24 h.

Figure S4

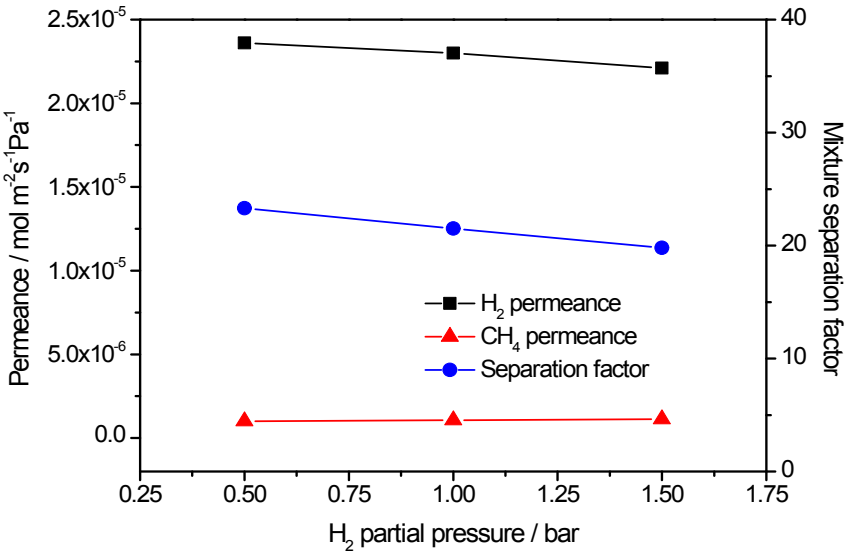

Figure S4. H_2/CH_4 selectivity and permeances of the ZIF-8 membrane prepared on PDA-functionalized SSN as function of the H_2 partial pressure at 100 ºC.

Table S1

Table S1. Single and mixed gases permeances and separation factors for the ZIF-8 membrane prepared on PDA-functionalized SSN at 100 ºC and 1 bar (in mixed gases permeation, equimolar mixtures have been used).

$Gas_{i/j}$	Knudsen constant	Separation performances of the ZIF-8 membrane supported on PDA-functionalized SSN					
		Single gas			Mixed gases		
		Permeances(i) ($mol/m^2 \cdot S^1 \cdot Pa^1$)	Permeances(j) ($mol/m^2 \cdot S^1 \cdot Pa^1$)	ISF	Permeances(i) ($mol/m^2 \cdot S^1 \cdot Pa^1$)	Permeances(j) ($mol/m^2 \cdot S^1 \cdot Pa^1$)	SF
H_2/CO_2	4.7	2.66×10^{-5}	3.02×10^{-6}	8.8	2.38×10^{-5}	2.94×10^{-6}	8.1
H_2/N_2	3.7	2.66×10^{-5}	1.73×10^{-6}	15.4	2.46×10^{-5}	1.64×10^{-6}	15.0
H_2/CH_4	2.8	2.66×10^{-5}	1.08×10^{-6}	24.6	2.35×10^{-5}	1.01×10^{-6}	23.2
H_2/C_3H_8	4.7	2.66×10^{-5}	6.01×10^{-8}	442.5	2.12×10^{-5}	6.43×10^{-8}	329.7

ISF: ideal separation factor; SF: separation factor.

Table S2

Table S2. Separation performances of ZIF-8 membranes prepared on PDA-functionalized SSN for the separation of equimolar H_2/CH_4 mixtures at 100 ºC and 1 bar.

Membrane	H_2 permeance ($mol \cdot m^{-2} \cdot s^{-1} \cdot Pa^{-1}$)	CH_4 permeance ($mol \cdot m^{-2} \cdot s^{-1} \cdot Pa^{-1}$)	H_2/CH_4 selectivity	Average selectivity	standard deviation of selectivity
M1	2.30×10^{-5}	1.02×10^{-6}	22.5	22.57	0.50
M2	2.26×10^{-5}	9.78×10^{-7}	23.1		
M3	2.37×10^{-5}	1.07×10^{-6}	22.1		

Table S3

Table S3. Comparison of the gas separation performances of the ZIF-8 membrane prepared on PDA-functionalized SSN in this study with other zeolite and MOF membranes from literatures.

Membrane	Pore size (nm)	Temperature (℃)	Mixture as separation performances				Reference
			Selectivity			H_2 permeances ($mol/m^2 \cdot S^1 \cdot Pa^1$)	
			H_2/CO_2	H_2/CH_4	H_2/C_3H_8		
DDR	0.36 x 0.44	300	3.5	/	/	7.9×10^{-6}	S1
Matrix $AlPO_4$	/	35	9.7	/	/	1.1×10^{-7}	S2
SAPO-34	0.38	200	23	/	/	7.0×10^{-8}	S3
LTA $AlPO_4$	0.40	25	7.6	4.3	146	2.5×10^{-7}	S4
NaA	0.41	20	6.7	4.9	15.8	2.3×10^{-7}	S5
ITQ-29	0. 41	300	7.8 [a]	6.2 [a]	127	3.6×10^{-7}	S6
MOF-5	1.40	/	KD [b]	KD [b]	/	4.7×10^{-6}	S7
HKUST-1	0.90	25	6.8	6	7.0	1.0×10^{-6}	S8
HKUST-1	0.90	25	4.6	3.0	/	6.7×10^{-7}	S9
IRMOF-3 [c]	/	25	4.1	2.0	2.4	1.1×10^{-6}	S10
MIL-53	0.73 x 0.77	/	5.4	4.0	/	5.0×10^{-7}	S11
SIM-1	0.34	25	2.4 [a]	2.6 [a]	/	8.2×10^{-7}	S12
ZIF-7	0.30	200	6.5	5.9	/	8.0×10^{-8}	S13
ZIF-8	0.34	25	4.5 [a]	11.3	/	5.1×10^{-8}	S14
ZIF-8	0.34	25	6.0	15	300	1.0×10^{-7}	S15
ZIF-8	0.34	23	/	/	545	4.4×10^{-7}	S16
ZIF-8	0.34	22	3.9	13.0	474	1.5×10^{-6}	S17
ZIF-22	0.29	50	7.2	5.2	/	1.9×10^{-7}	S18
ZIF-69	4.4	25	2.7 [a]	3.7 [a]	/	6.50×10^{-8}	S19
ZIF-90	0.37	200	7.2 [a]	15.3	/	2.51×10^{-7}	S20
ZIF-90	0.37	35	1.8 [a]	2.7 [a]	/	3.19×10^{-8}	S21
ZIF-90 [d]	/	200	15.3	18.9	/	2.02×10^{-7}	S22
ZIF-90 [e]	/	225	20.1	70.5	458.3	2.85×10^{-7}	S23
ZIF-8	0.34	100	8.1	23.2	329.7	$> 2.1 \times 10^{-5}$	This work

[a] ideal separation factor, [b] Knudsen diffusion, [c] AM6 modified IRMOF-3, [d] ethanolamine modified ZIF-90, [e] APTES modified ZIF-90.

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