Supplementary information

Facilitated transport of small molecules and ions for energy-efficient membranes

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Table S1. A summary of facilitated CO_2 transport membranes involving nucleophilic addition reaction

Membrane	CO_2 permeance (GPU) or permeability (Barrer)	CO_2/N_2 selectivity	Testing conditions[a]	References
Polymeric membranes				
PVAm/PPO	440 GPU	183	Mixed gas (10 vol%CO_2), 25°C, 5 bar	1
PVAm–EDA /PSf	607 GPU	106	Mixed gas (15 vol%CO_2), 25°C, 1.1 bar	2
PVI-Zn/PSf	1120 GPU	83	Mixed gas (15 vol%CO_2), 25°C, 1.1 bar	3
PVAm–MC/PS	1180 GPU	410	Mixed gas (15 vol%CO_2), 25°C, 1.1 bar	4
DNMDAm–DGBAmE–TMC/PDMS/PSf	1600 GPU	138	Mixed gas (15 vol%CO_2), 25°C, 1.1 bar	5
DAmBS–DGBAmE–TMC/PDMS/PSf	5830 GPU	86	Mixed gas (15 vol%CO_2), 25°C, 1.1 bar	6
PVAm–PIP /PSf	6500 GPU	277	Mixed gas (15 vol%CO_2), 25°C, 1.1 bar	7
PAA-C_3H_7–PVA	297 Barrer	341	Mixed gas (20 vol%CO_2 + 40 vol% H_2), 110°C, 2 atm	8
PANI /PP	3460 Barrer	540[b]	Mixed gas (10 vol%CO_2), 25°C, 1.28 bar	9
PAA-C_3H_7–PVA-Poly(siloxane)	6500 Barrer	>650	Mixed gas (20 vol%CO_2 + 40 vol% H_2), 110°C, 2 atm	10
Mixed matrix membranes				
PVAm–PANI /PSf	1200 GPU	120	Mixed gas (15 vol%CO_2), 25°C, 1.1 bar	11
PVAm–PVP@PANI /PSf	3080 GPU	240	Mixed gas (15 vol%CO_2), 25°C, 1.1 bar	12
PEI–hydrotalcite	5693 GPU	268	Mixed gas (15 vol%CO_2), 25°C, 1.1 bar	13
Pebax–PEI@MCM41	1521 Barrer	102	Pure gas, 25°C, 3 bar	14
SPEEK–PEI@TiO_2	1629 Barrer	64	Pure gas, 25°C, 3 bar	15

[a] All the membranes were tested at humidified state.
[b] The value is actually CO_2/CH_4 selectivity.

Table S2. Typical facilitated CO_2 transport membranes containing amino acid ionic liquids

Membrane	CO_2 permeability (Barrer)	CO_2/N_2 selectivity	Testing conditions	References
$[P_{4444}]$[Gly]	5000	48	Mixed gas (10 vol%CO_2), 100°C, 1 atm, dry membrane	16
$[P_{66614}]$[Gly]	6900	100	Mixed gas (10 vol%CO_2), 100°C, 1 atm, dry membrane	17
[Emim][Gly]	8300	146	Mixed gas (10 vol%CO_2), 100°C, 1 atm, dry membrane	16
$[P_{4444}]$[mGly]	10000	53	Mixed gas (10 vol%CO_2), 100°C, 1 atm, dry membrane	17
$[P_{4444}]$[Pro]	10600	100	Mixed gas (10 vol%CO_2), 100°C, 1 atm, dry membrane	18
	30000	200	Mixed gas (2 vol%CO_2), 100°C, 1 atm, humidified membrane	18
$[P_{4444}]$[Pro] –PVP (gel)	7000	170	Mixed gas (2.5 vol%CO_2), 100°C, 1 atm, dry membrane	19

[a] The value is actually CO_2/CH_4 selectivity.
[b] Values are approximated from plots.

Table S3. Typical facilitated olefin transport membranes suppressing silver reduction

Polymer	Silver salt	Additive	Key anti-reduction species	References
PVP	$AgNO_3$	—	NO_3^-	20
POZ	$AgNO_3$	$BMIm^+NO_3^-$	$BMIm^+NO_3^-$	21
PVP	$AgBF_4$	dioctyl phthalate/HBF_4	dioctyl phthalate	22
PEP	$AgBF_4$	—	PEP	23
Pebax 2533	$AgBF_4$	H_2O_2/HBF_4	H_2O_2	24
POZ	$AgBF_4$	$Al(NO_3)_3$	NO_3^-	25
PES/PEO	$AgBF_4$	$Cu(NO_3)_2$	NO_3^-	26
PVDF-HFP	$AgBF_4$	$BMIm^+BF_4^-$	PVDF-HFP $BMIm^+BF_4^-$	27

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