

Supporting Information

Interfacial Design of Ternary Mixed Matrix Membranes Containing Pebax 1657/Silver-Nanopowder/[BMIM][BF₄] for Improved CO₂ Separation Performance

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Table S1. Silver nanopowder properties (Aldrich).

properties	content	unit
Size	<100	nm
Purity	99.5	%
Molar mass	107.87	g/mol
Relative density	10.49	g/ml
Appearance	powder	-
Melting point	960	°C

Table S2. Pebax 1657 properties (Arkema)¹.

properties	content	unit
Density(20°C)	1.14	g/cm ³
Melting point(10°C/min)	204	°C
Flexural modulus	80	MPa
Glass transition temperature(10°C/min)	-40	°C
Water absorption	120	%
Humidity absorption	4.5	%

Table S3. ([BMIM][BF₄]) properties (Aldrich)¹.

properties	content	unit
Purity(GC)	≥ 97.0	%
Density(20°C)	1.21	g/cm ³
Molar mass	226.02	g/mol
Water	≤ 1	%
Melting point	-71.0	°C
Flash point	288	°C

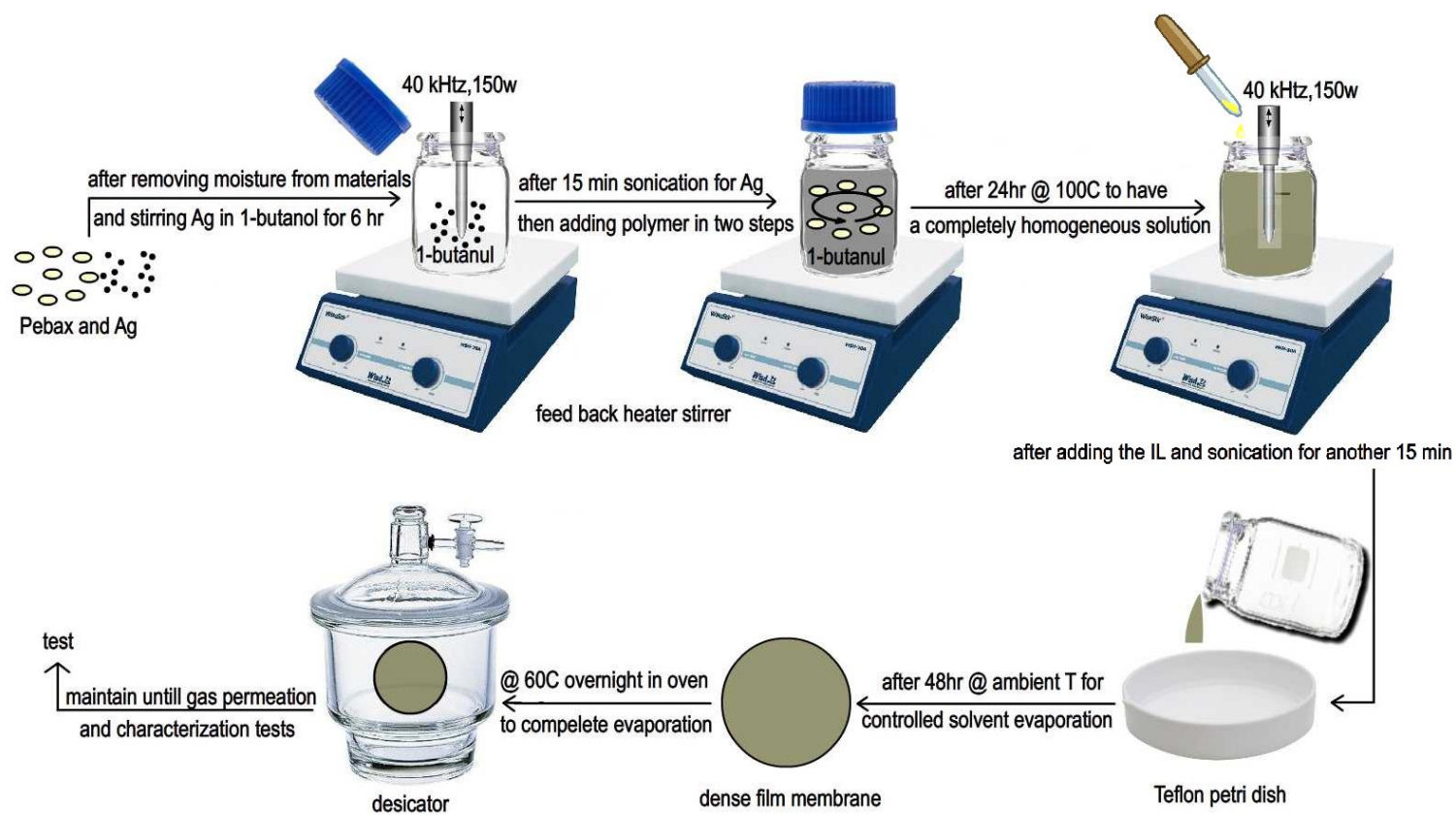


Figure S1. Schematic diagram of the membranes preparation procedure.

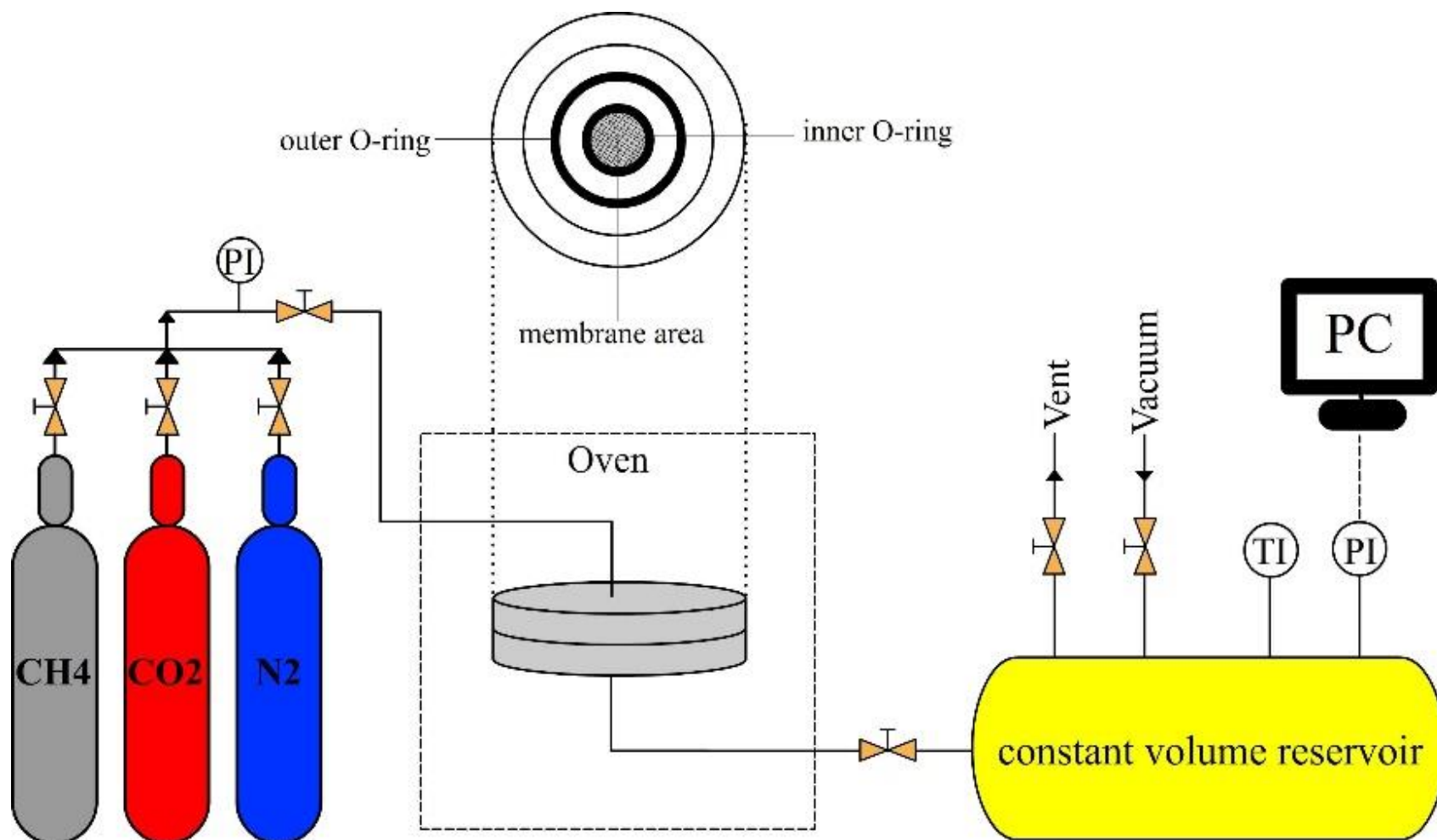
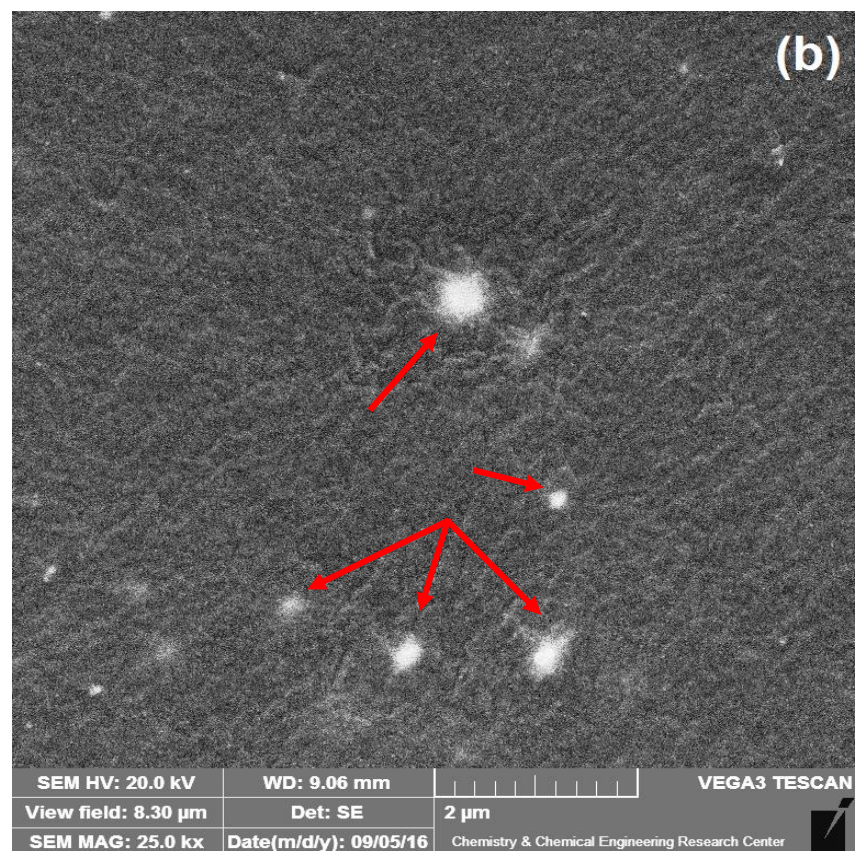
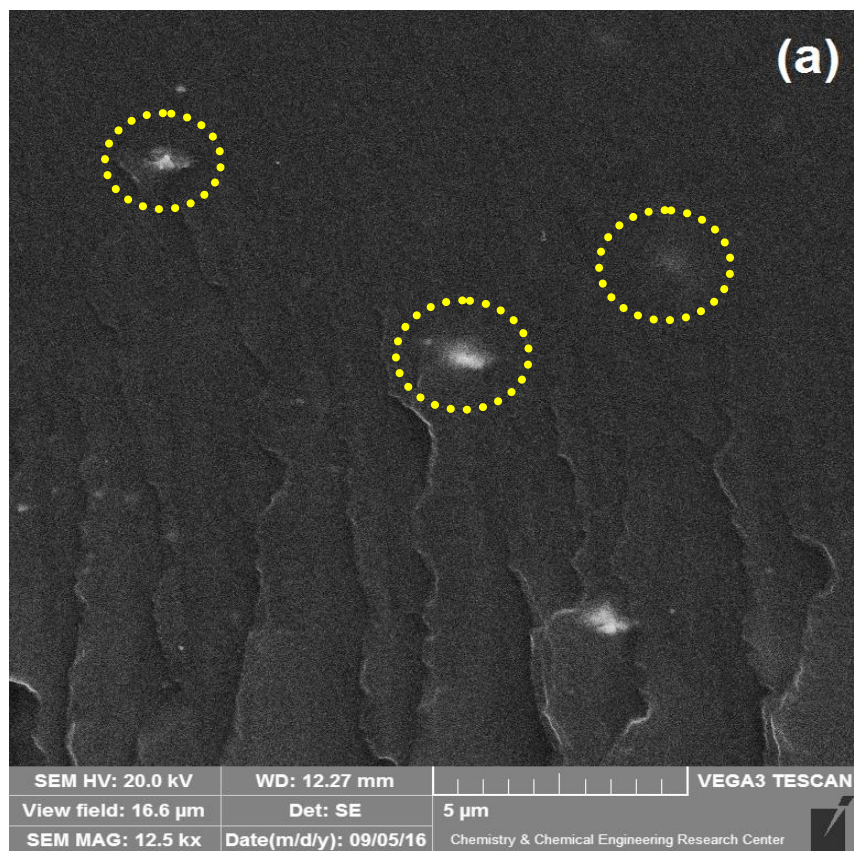


Figure S2. Schematic diagram of gas permeation set-up¹.

In ternary MMMs, the presence of IL improves the interfacial adhesion and at the filler/polymer interface, fillers are entirely covered by the polymer layer and no micron size non-selective voids are identified and silver nanoparticles are completely sunken into the polymer matrix. This is affirmed by cross-section at higher magnifications ([Figures S3](#)). Indeed, the optimized mixing protocol and the illustrious affinity of positively polarized silver nanoparticles induced by employing the ionic liquid with polymer chains, are probably the main factors of the polymer/filler strong interaction.



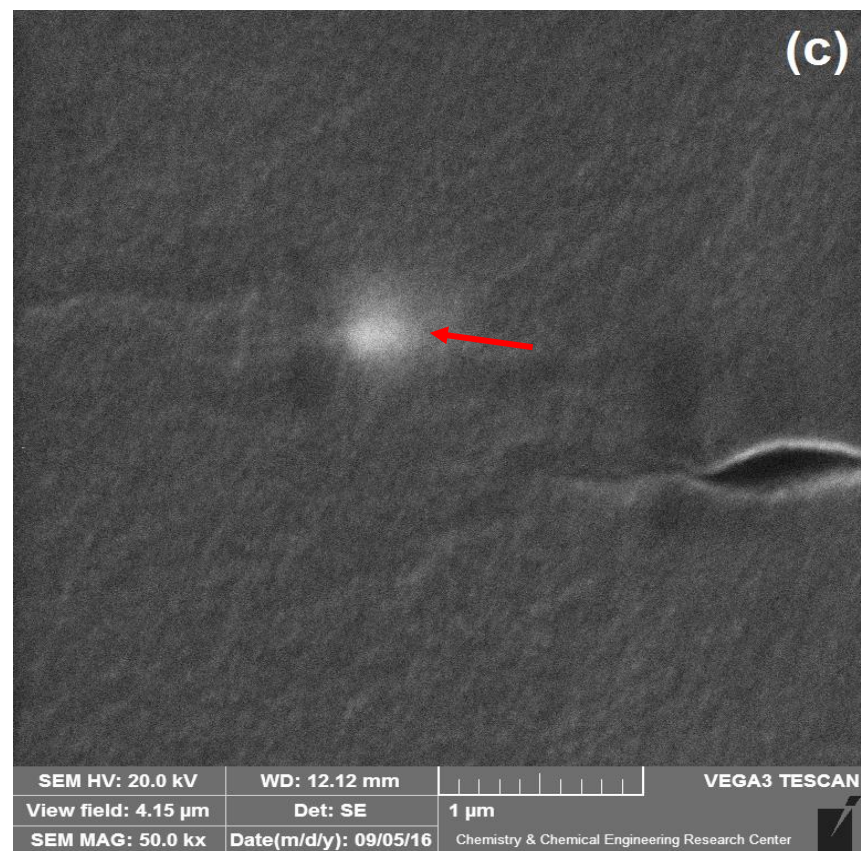


Figure S3. SEM images of (a) Pebax 1657/1.0%Ag cross-section at higher magnification (b) Pebax 1657/0.5%Ag/50%IL cross-section at higher magnification, (c) Pebax 1657/1.0%Ag/50%IL cross-section at higher magnification.

References

- (1) Ghasemi Estahbanati, E.; Omidkhah, M.; Amooghin, A. E., Preparation and Characterization of Novel Ionic Liquid/Pebax Membranes for Efficient CO₂/Light Gases Separation. *Journal of Industrial and Engineering Chemistry* **2017**, Accepted, <http://dx.doi.org/10.1016/j.jiec.2017.02.017>.