

Pioneering the preparation of porous PIM-1 membranes for enhanced water vapor flow

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Supplementary Information

Table S1: Composition of casting solutions and membrane casting parameters

Name	Composition (%wt.)	Precipitation bath	Batch	Membrane casting thickness	M _w (kDa)
PM-1	PIM/THF/DMAc/EtOH: 17.5/67.5/12.75/2.25	Water	PIM-LT-1	200 μm	76
PM-2	PIM/THF/DMAc: 17.25/69.5/13.25	Water	PIM-LT-1	150 μm	76
PM-3	PIM/NMP/THF: 12.5/69.5/18	Water	PIM-LT-2	150 μm (on glass substrate)	76
PM-4	PIM/DCB: 10/90	MeOH	PIM-LT-2	150 μm (on glass substrate)	76

PM-5	PIM/DCB: 10/90	MeOH/BuOH 50:50	PIM-LT-2	150 μm (on glass substrate)	76
PM-7	PIM/NMP/THF: 13/80/7	MeOH	PIM-LT-2	150 μm (on glass substrate)	76
PM-8	PIM/NMP/THF: 14.5/80.5/5	Water	PIM-LT-2	150 μm	76
PM-10	PIM/NMP/THF: 13/79/8	Water	PIM-LT-1	150 μm	76
PM-12	PIM/NMP/THF: 11.5/72/16.5	Water	PIM-HT	150 μm	142
PM-14	PIM/NMP/THF: 13/80/7	Water	PIM-LT-2	150 μm	76

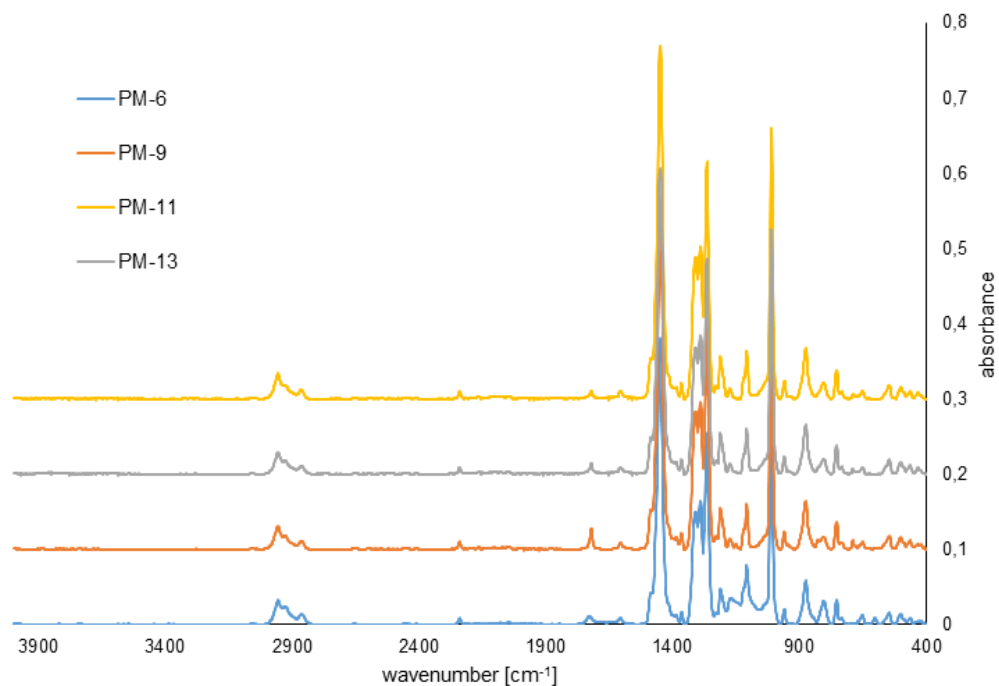


Figure S1: Comparative FTIR spectrum of PM-6, PM-9, PM-11 and PM-13

FTIR analysis was carried out to characterize the porous PIM-1 membranes which are PM-6, PM-9, PM-11 and PM-13. FTIR spectrum show the absorption bands at 2239 cm^{-1} and 1265 cm^{-1} which correspond to nitrile groups ($\text{C}\equiv\text{N}$ stretching). The absorption band between $2800\text{--}2900\text{ cm}^{-1}$ and at 1146 cm^{-1} are associated with CH_2 stretching and bending vibration modes. The spectrum in the region at $1350\text{--}1250\text{ cm}^{-1}$ originates from C-O stretching mode. Characteristic C-N stretching appears at 1009 cm^{-1} and aromatic sp^2 C-H bending is visible at 874 cm^{-1} .

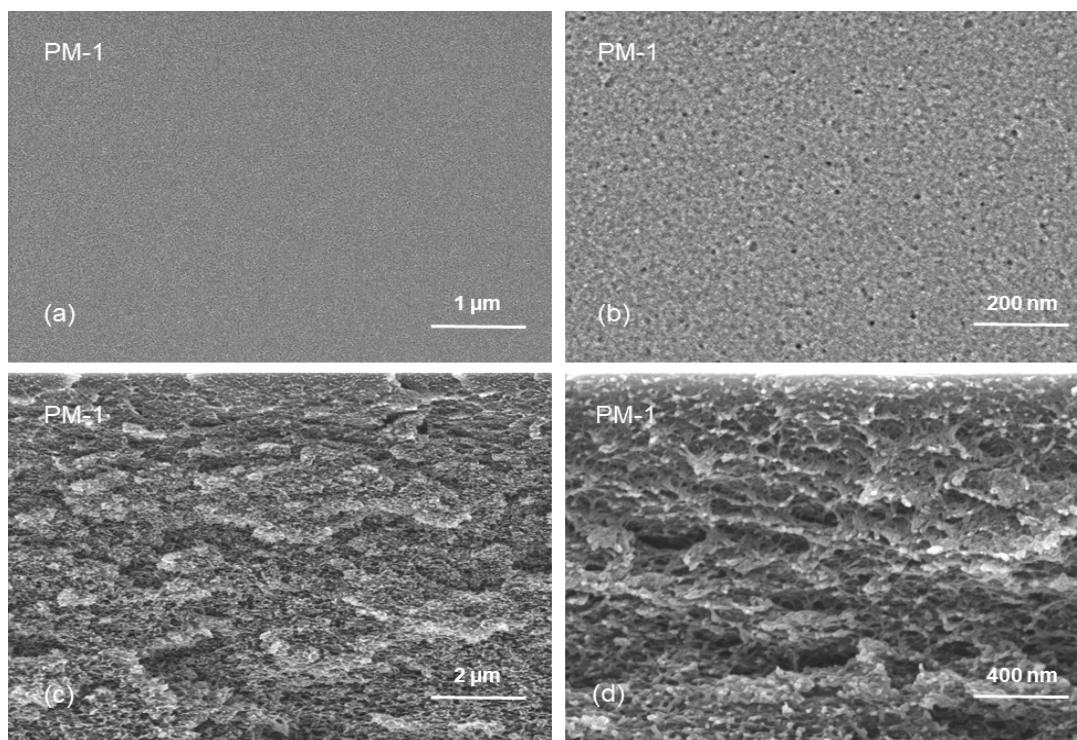


Figure S2: Surface (a, b) and cross-sectional (c, d) morphology of PM-1

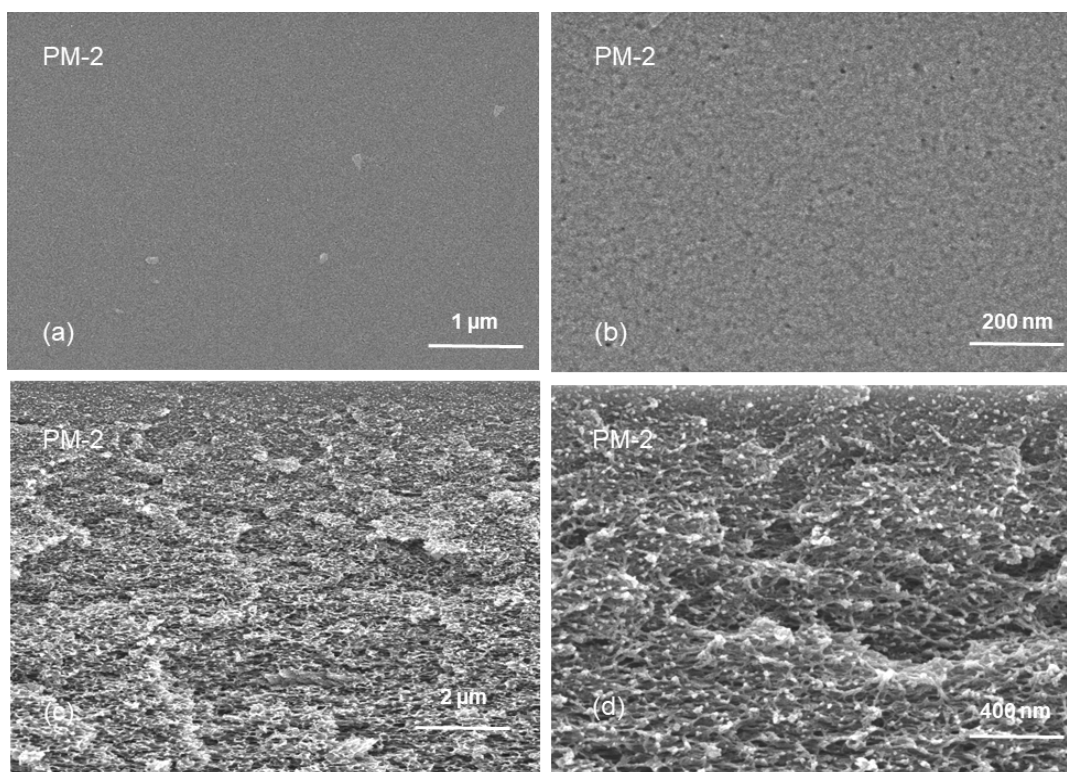


Figure S3: Surface (a, b) and cross-sectional (c, d) morphology of PM-2

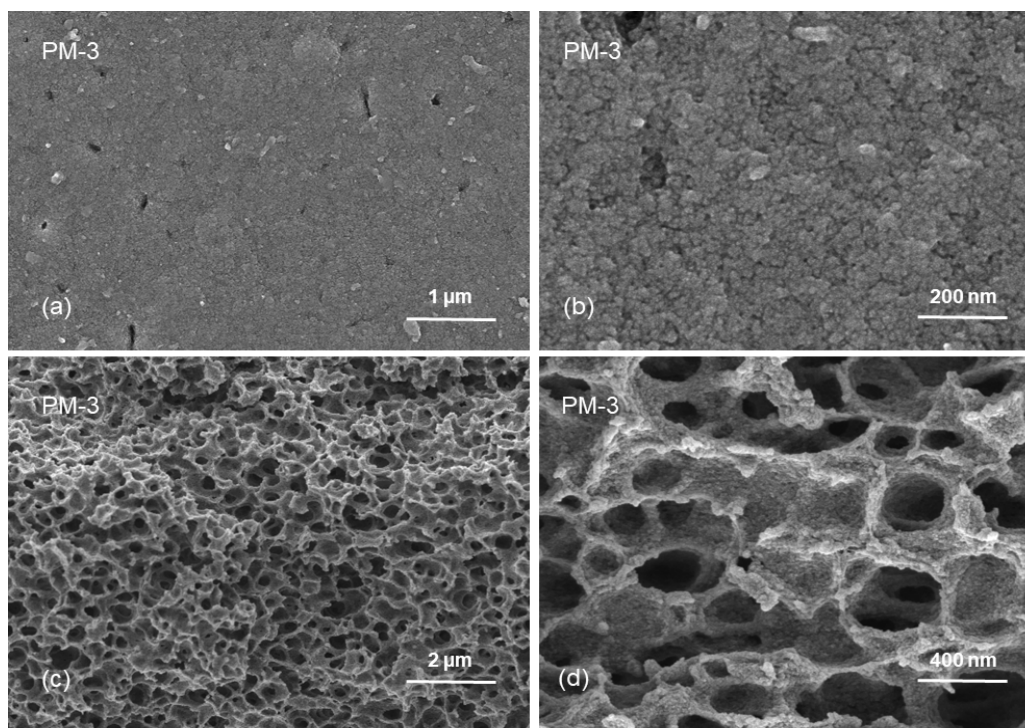


Figure S4: Surface (a, b) and cross-sectional (c, d) morphology of PM-3

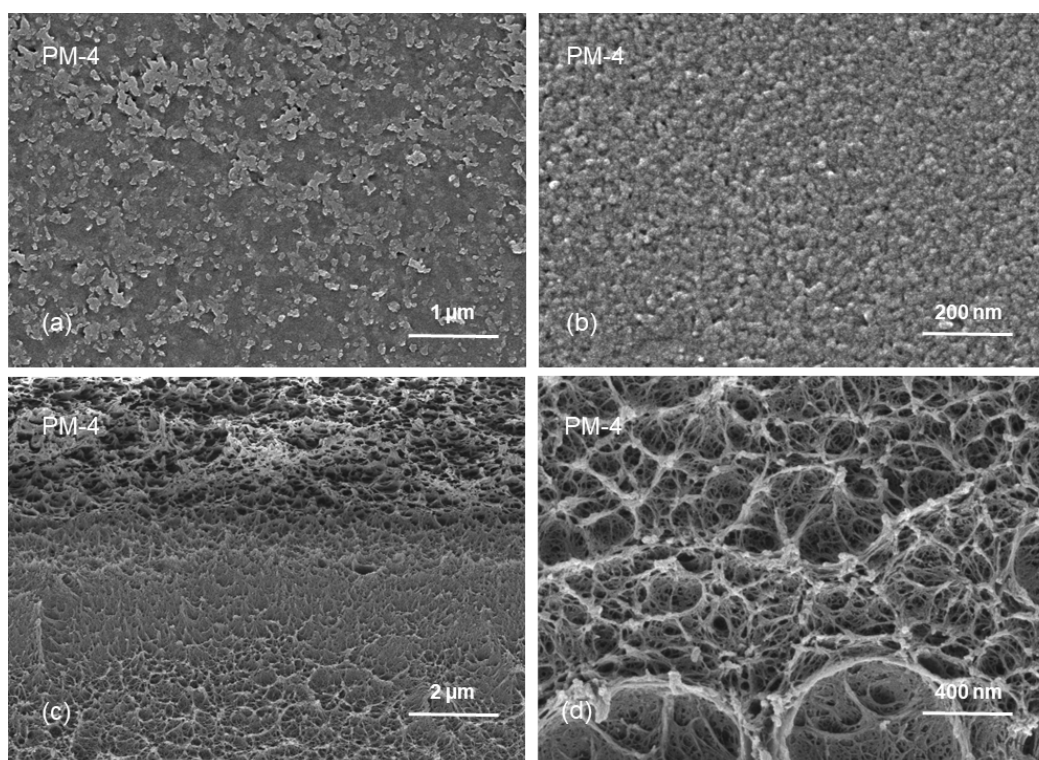


Figure S5: Surface (a, b) and cross-sectional (c, d) morphology of PM-4

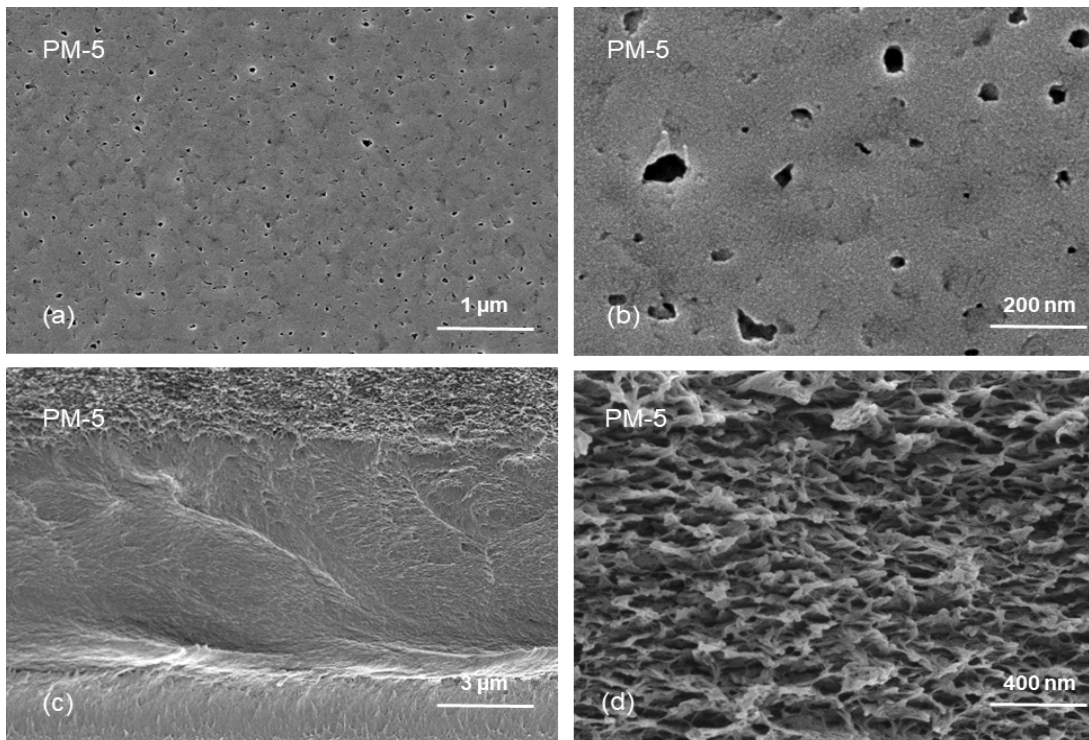


Figure S6: Surface (a, b) and cross-sectional (c, d) morphology of PM-5

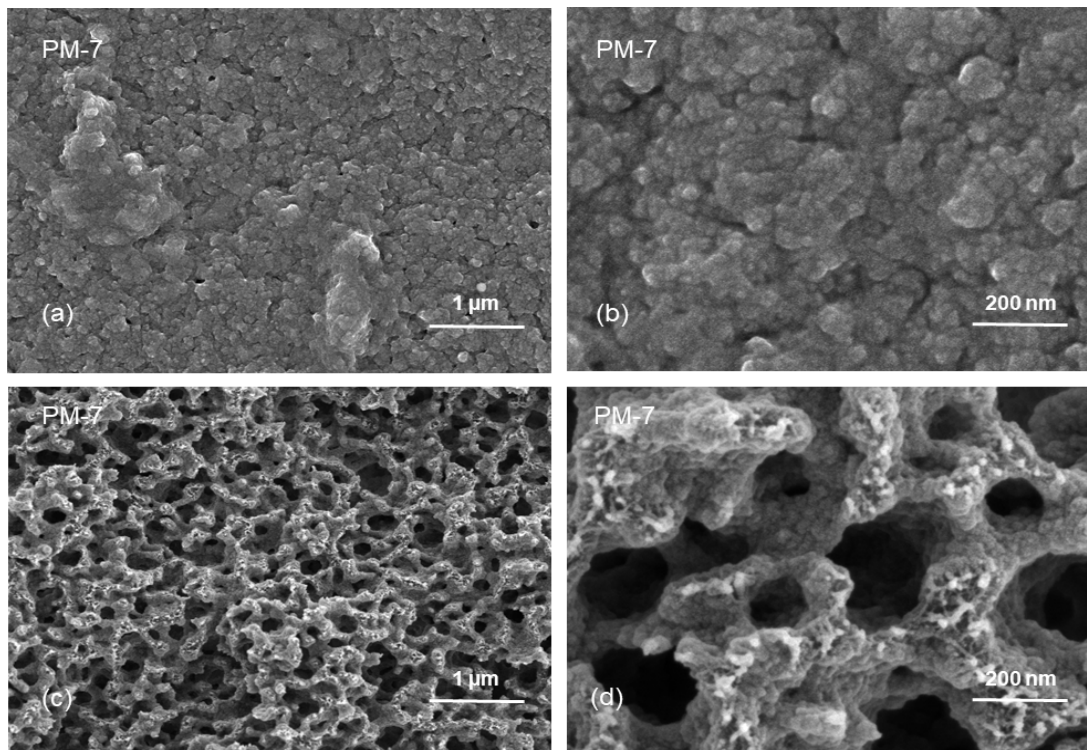


Figure S7: Surface (a, b) and cross-sectional (c, d) morphology of PM-7

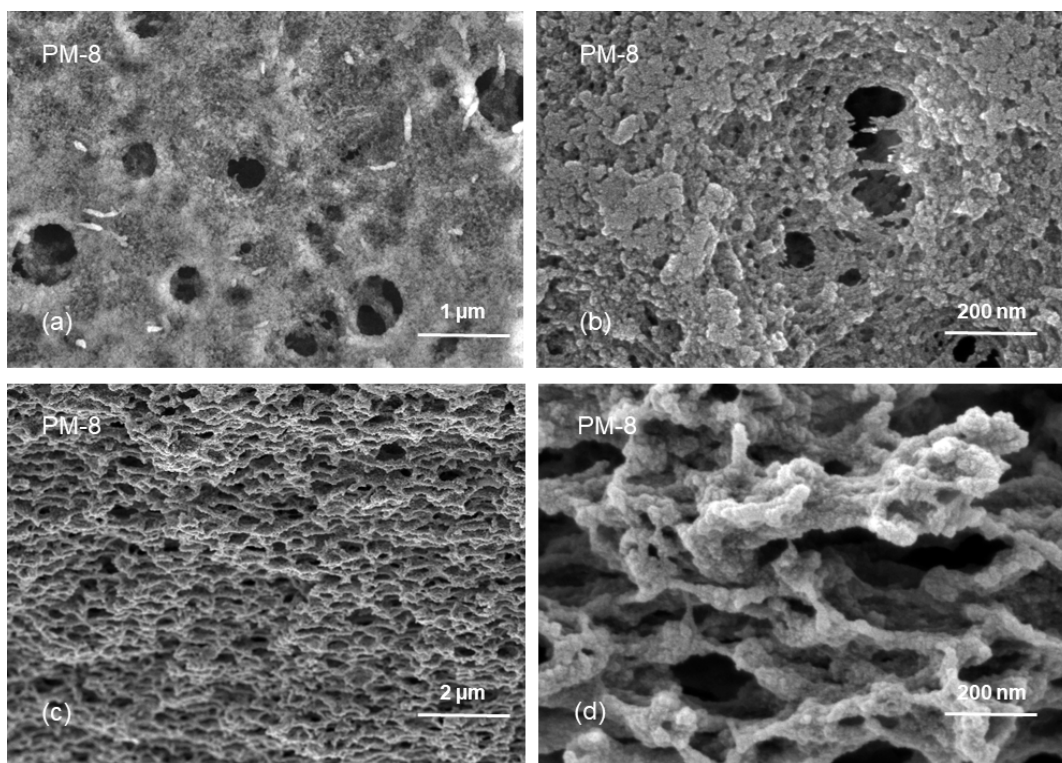


Figure S8: Surface (a, b) and cross-sectional (c, d) morphology of PM-8

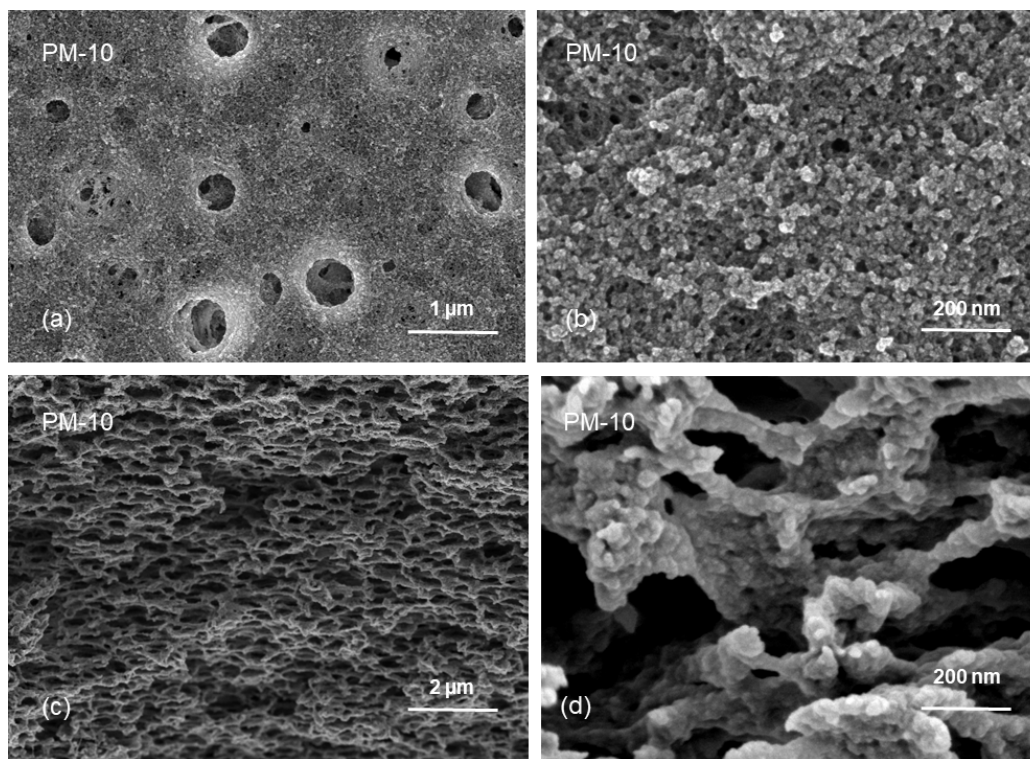


Figure S9: Surface (a, b) and cross-sectional (c, d) morphology of PM-10

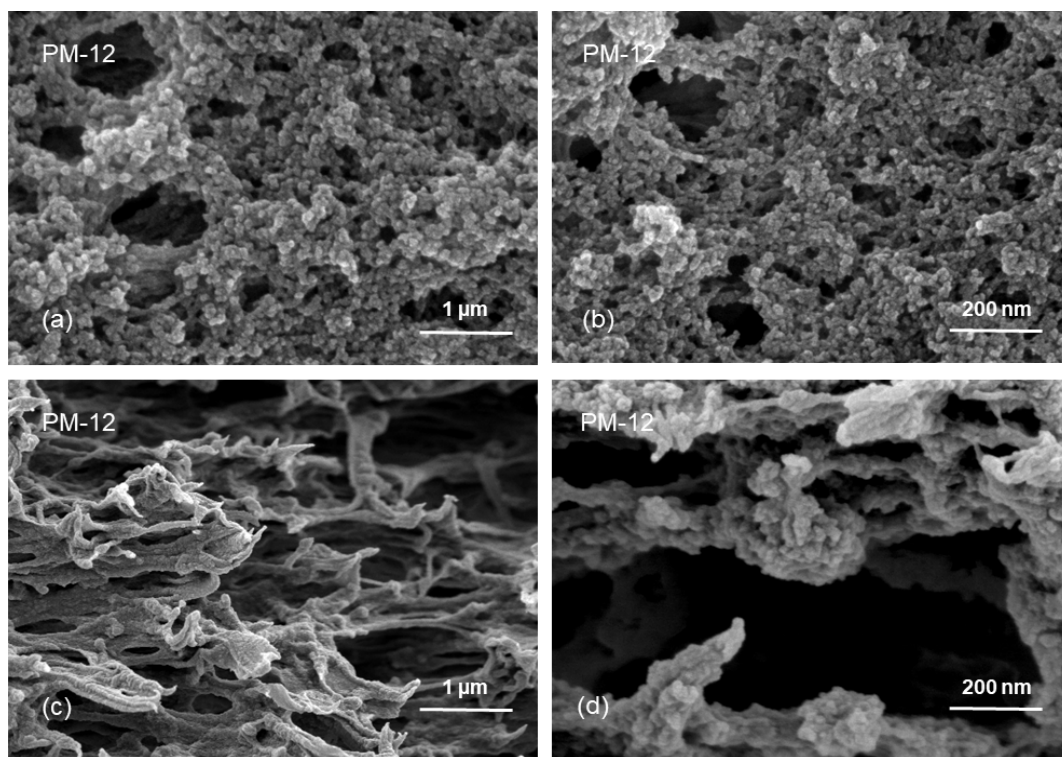


Figure S10: Surface (a, b) and cross-sectional (c, d) morphology of PM-12

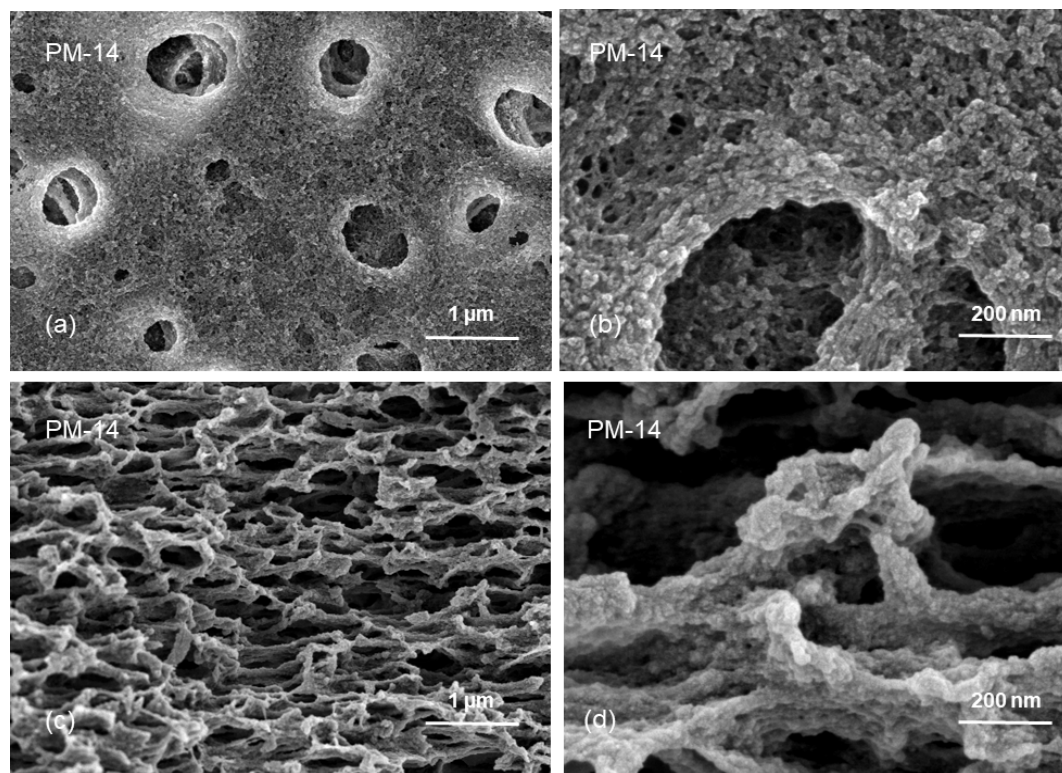


Figure S11: Surface (a, b) and cross-sectional (c, d) morphology of PM-14

Table S2: Water vapor permeance of PIM-1 membranes

	Water permeance (m ³ (STP)m ⁻² h ⁻¹ bar ⁻¹)	Batch
PM-1	35	PIM-LT-1
PM-2	42	PIM-LT-1
PM-8	124	PIM-LT-2
PM-10	350	PIM-LT-1
PM-14	201	PIM-LT-2

The measurement was performed at 30 °C and first measurement points of each membrane are displayed in **Table-S2**. PM-3, PM-4, PM-5 and PM-7 membranes were casted on a glass substrate. Therefore, water vapor permeance measurement could not be carried out since the membranes were not mechanically stable, it was difficult to handle these samples.

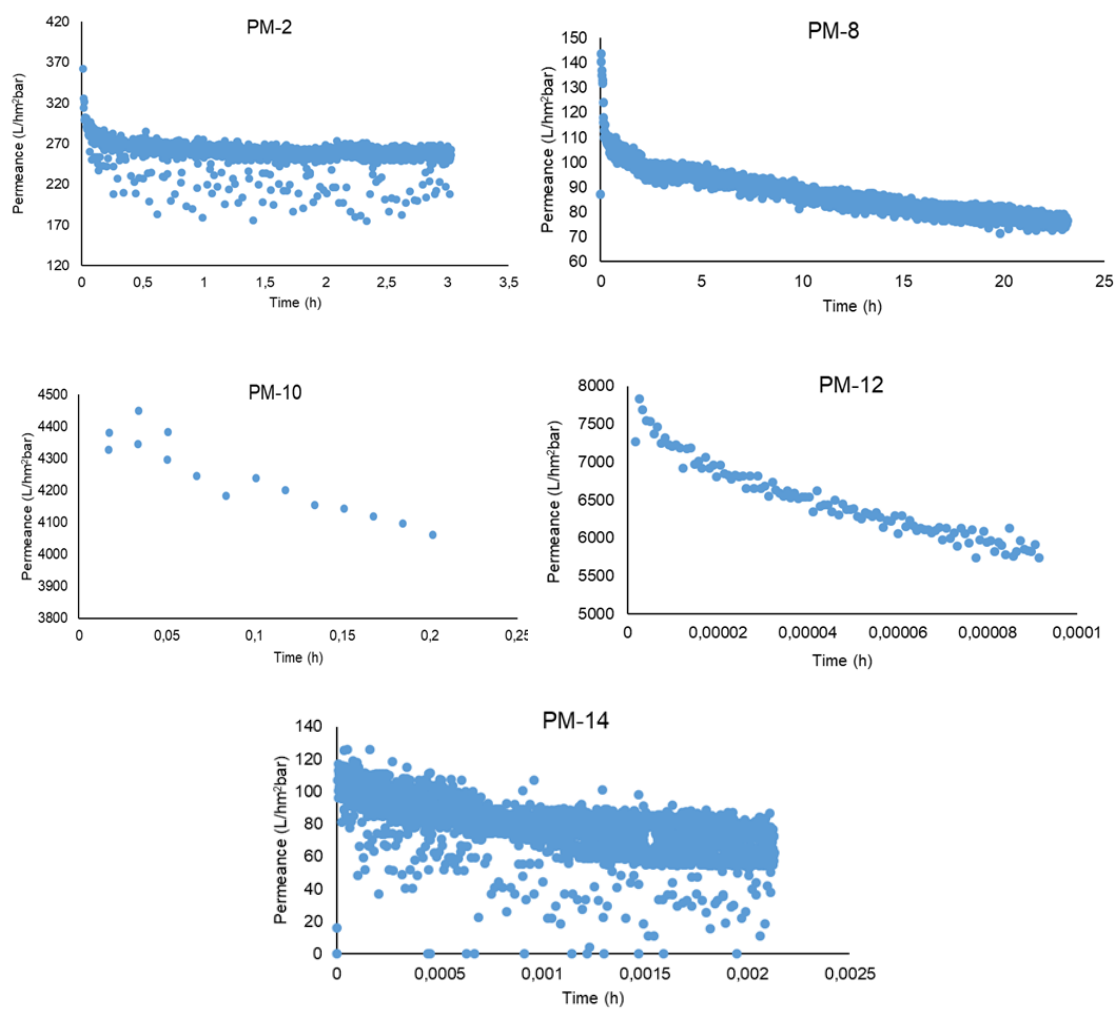


Figure S12: Water flux of membranes

Water flux measurement of PM-1 could not be carried out due to exfoliation of the membrane from the support.