Electronic Supplementary Material (ESI) for Analytical Methods

Supporting Information

Rapid Fabrication of Nanoporous Membrane Arrays and Single-pore Membranes from Parylene C

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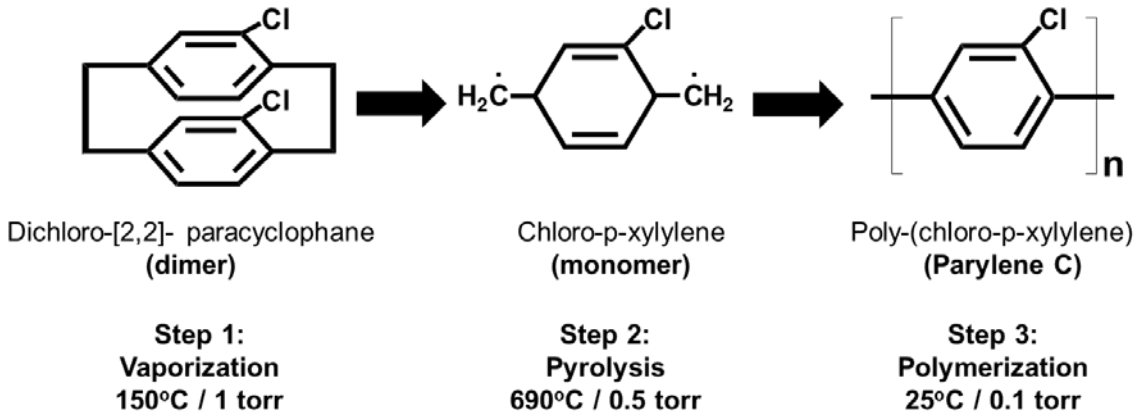

Figure S1. Reaction scheme and deposition parameters for CVD of parylene C.

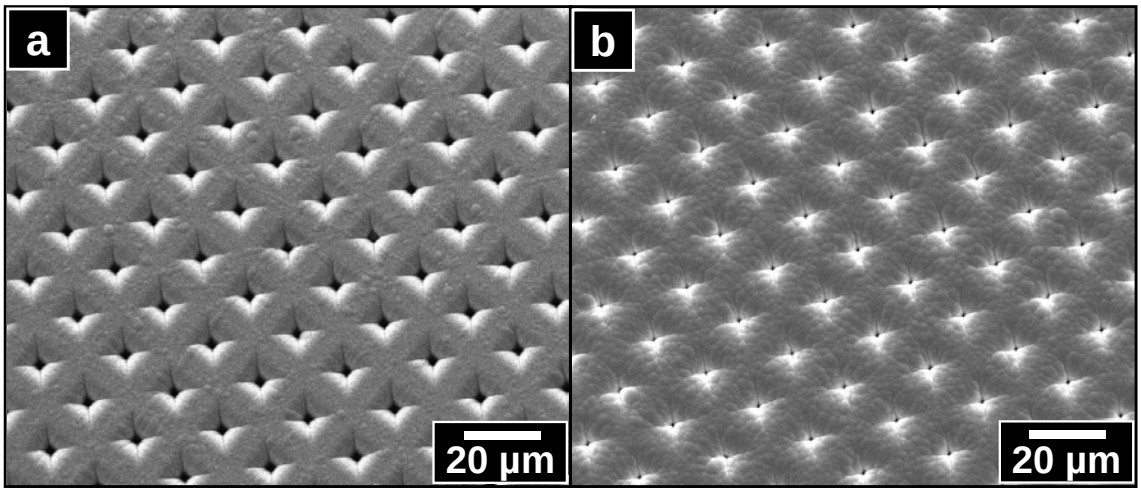

Figure S2. Electron micrographs for each side of a single PMA illustrate uneven deposition when membranes are not oriented perpendicular to the chamber surface.

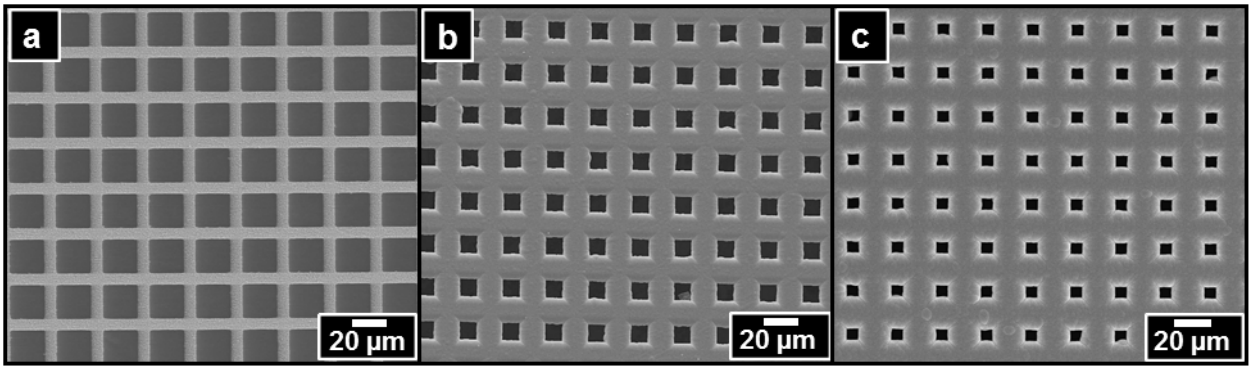

Figure S3. Electron micrographs for $Mesh_{19\mu m}$ **a)** before and **b)** after 7.0 g of DCP deposition and **c)** after 9.3 g of DCP deposition.

Table 1. Membrane pore sizes with change in DCP masses

$Mesh_{11\mu m}$		**$Mesh_{19\mu m}$**	
DCP mass (g)	**Membrane pore size (µm)**	**DCP mass (g)**	**Membrane pore size (µm)**
0.0	10.4 ± 0.3	0.0	18.7 ± 0.1
4.0	4.9 ± 0.2	6.0	9.9 ± 0.7
6.0	2.7 ± 0.2	7.0	8.0 ± 0.3
7.0	1.5 ± 0.1	9.0	6.4 ± 0.6
8.0	0.7 ± 0.1	9.3	5.4 ± 0.5
8.2	0.1 ± 0.04		
8.4	closed		

n ≥ 10

Table S1. Summary of results obtained for PMAs fabricated with two different mesh sizes and varying DCP masses, used for calibration graphs shown in Figure 3C (main text). Average pore sizes reported here are from SEM characterization of templated silica structures. High standard deviation observed does not imply the non-conformal nature of the deposition scheme. As noted in the main body of the text and in the supporting information (Figure S1), uneven deposition rates are observed if the EM grids are not oriented upright in the parylene deposition chamber. High standard deviation is reflective of the uneven deposition that results in non-uniform pore sizes within the same membrane.

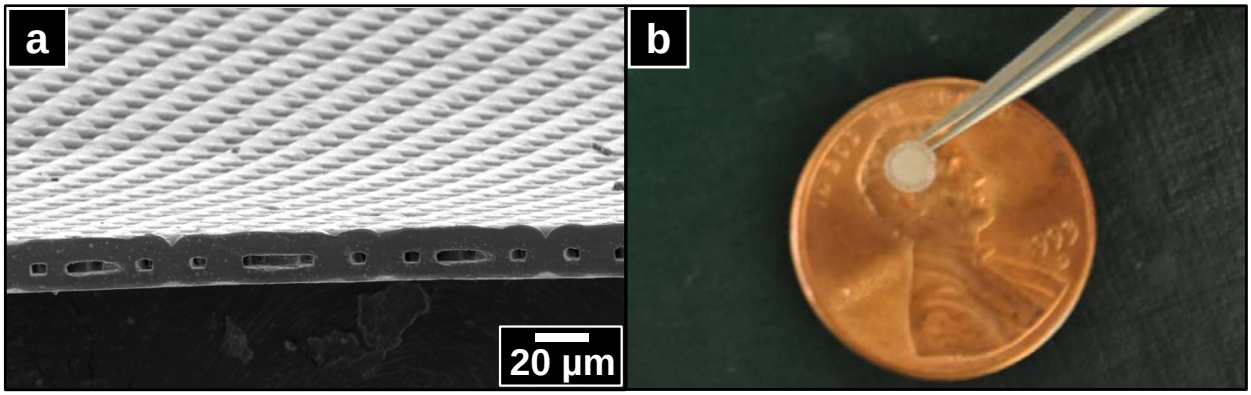

Figure S4. The copper mesh structure was dissolved to obtain free standing PMAs **a)** A cross-sectional electron micrograph of a 720 nm parylene C polymer membrane **b)** A photograph of a 720 nm PMA .

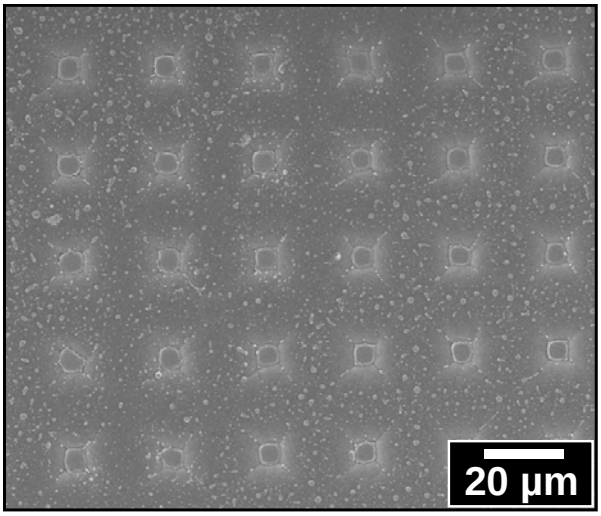

Figure S5. An electron micrograph of a PMA where pores are filled in with silica structures. Parylene C was dissolved to release these structures over an alumina membrane.

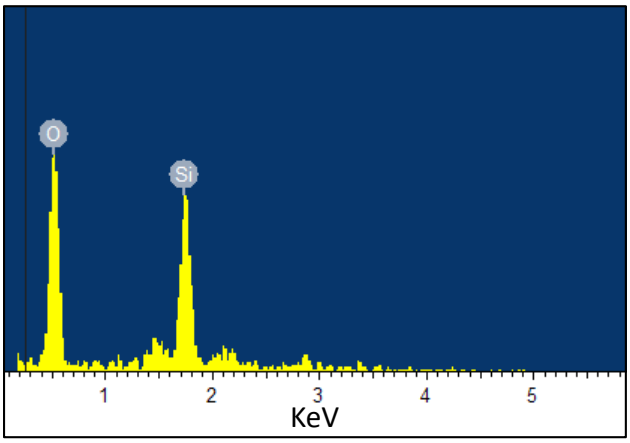

Figure S6. Energy dispersive X-ray analysis of silica micro/nanostructures with an incident electron beam of 5.0 keV.

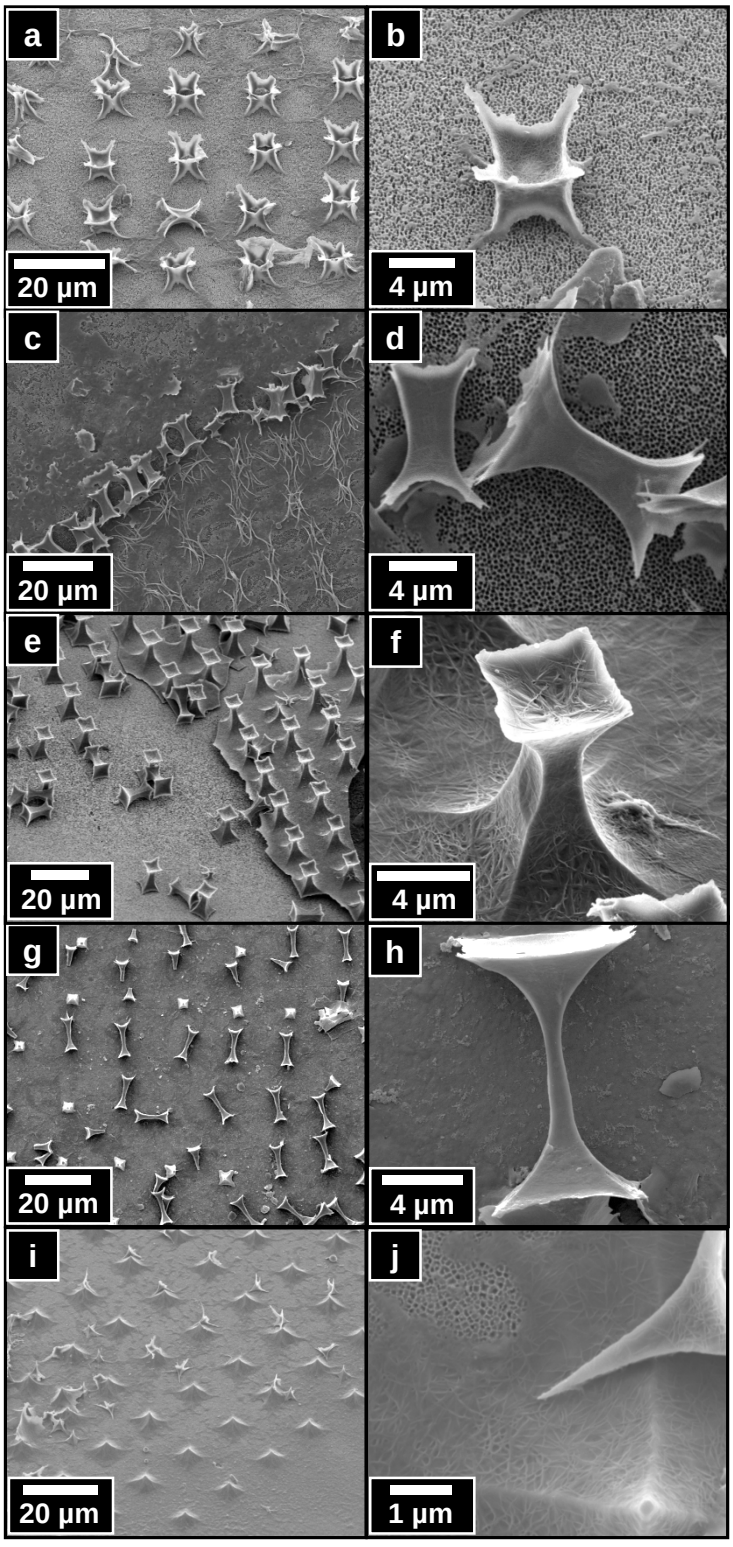

Figure S7. Silica structures were grown within pores and the polymer was dissolved away to liberate structures for pore size characterization. Shown here are SEM

micrographs of silica structures released from $Mesh_{11\mu m}$ PMA and reported dimensions are for pore sizes (for pore size measurement details, see Figure 2d). **a)** SEM micrograph for silica structures obtained from a PMA deposited with 4.0 g of DCP and calculated average sizes were 4.9 ± 0.2 µm. **b)** A high-magnification electron micrograph for a single silica structure is shown. **c)** SEM micrograph for silica structures obtained from a PMA deposited with 6.0 g of DCP and calculated average sizes were 2.7 ± 0.2 µm. **d)** A high-magnification electron micrograph for a single silica structure is shown. **e)** SEM micrograph for silica structures obtained from a PMA deposited with 7.0 g of DCP and calculated averages sizes were 1.5 ± 0.1 µm. **f)** A high-magnification electron micrograph for a single silica structure is shown. **g)** SEM micrograph for silica structures obtained from a PMA deposited with 8.0 g of DCP and calculated average sizes were 0.7 ± 0.1 µm. **h)** A high-magnification electron micrograph for a silica structure is shown. **i)** SEM micrograph for silica structures obtained from a PMA deposited with 8.2 g of DCP and calculated average sizes were 0.1 ± 0.04 µm. **j)** A high-magnification electron micrograph for a single silica structure is shown. However, in this case, silica structures obtained were fragile and collapsed under their own weight.

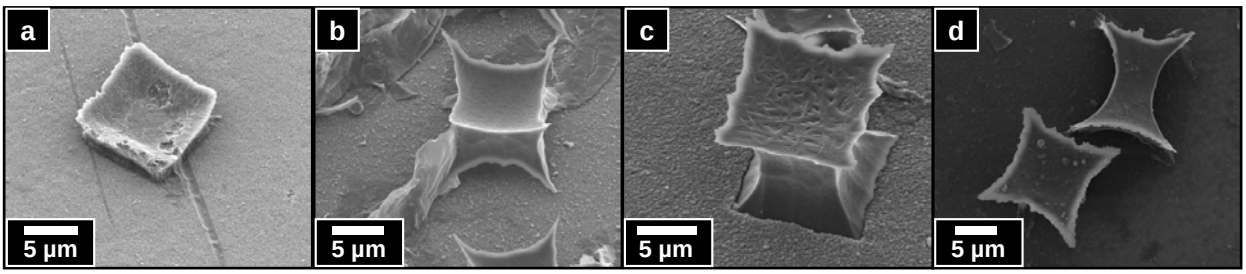

Figure S8. Silica structures were grown within pores and the membrane was subsequently dissolved to liberate structures for pore geometry characterization. Shown here are SEM micrographs of silica structures released from $Mesh_{19\mu m}$ PMA and reported dimensions are for pore sizes (for pore size measurement details, see Figure 2d). **a)** Silica structures obtained from a PMA deposited with 6.0 g of DCP were found to be 9.9 ± 0.7 µm in size. **b)** Silica structures obtained from a PMA deposited with 7.0 g of DCP were 8.0 ± 0.3 µm in size. **c)** Silica structures obtained from a PMA deposited with 9.0 g of DCP were 6.4 ± 0.6 µm in size. **d)** Silica structures obtained from PMAs deposited with 9.3 g of DCP were found to be 5.4 ± 0.5 µm in size.

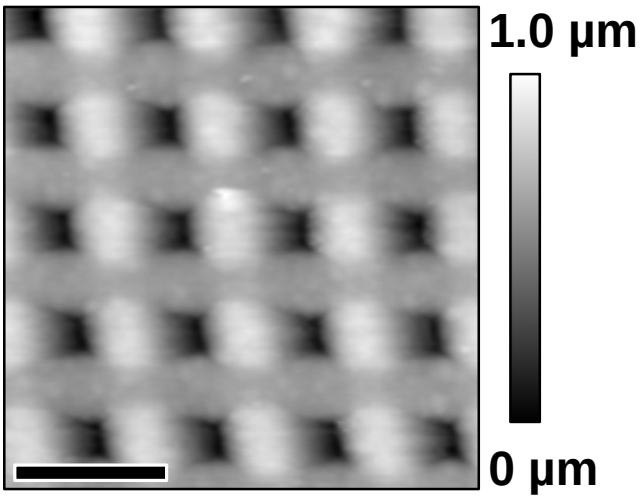

Figure S9. Topography image obtained when ion current image shown in Figure 4c was recorded. Image scale bar is 25 µm.