Electronic Supplementary Material (ESI) for RSC Advances.

Oil-gated Isoporous Membrane with Micro-apertures for Controllable Pressure-induced Passive Flow Regulator

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Table S1. Comparison of flow stabilization systems.

System type	Operation mechanism	Advantage	Limitation	Ref.
PID flow controllers	PID based electrically control	Quick response time and high accuracy	Expensive and complex systems, non-space effective	S1,S2
Spring based safety valves	Spring force-based valve opening /closing control	Self-actuating and cost-effective	Limited shapes, sizes, and pressure ranges, non-space effective	S3,S4
Deformable soft and flexible valve	Pressure induced soft material deformation to adjust the fluidic resistance	Passively-actuating, simple, light, thin and space-efficient	Relatively high pressure, non-linearity between pressure and deformation, and clogging issue	S5-S10
This study	Oil-gating pressure control	Precise control via linearity, adjustibility and passively-actuating	Relatively low operating pressure and pressure-osciliating issue	-

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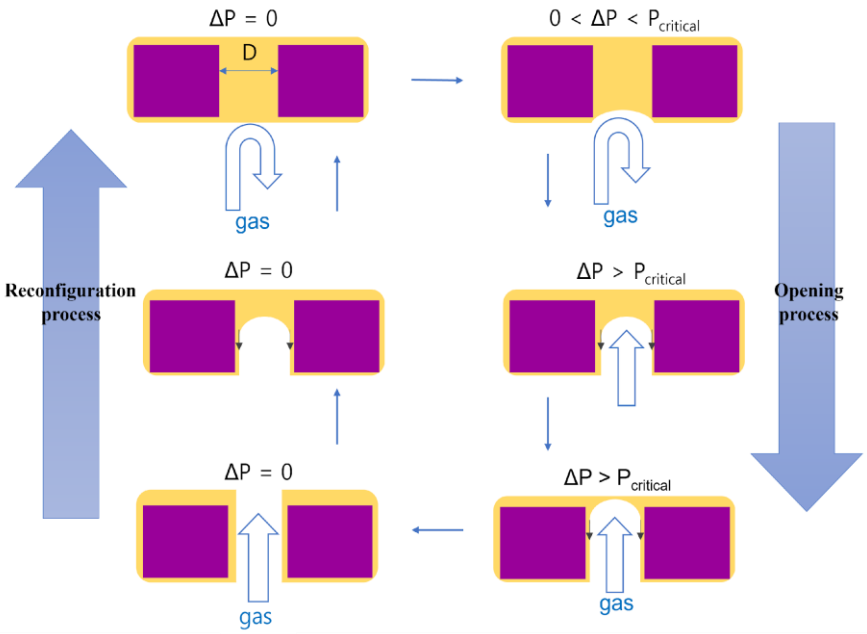

Figure S1. Schematic illustration of opening and closing(reconfiguration) behaviour of the oil-gated apertures depending on the applied pressure.

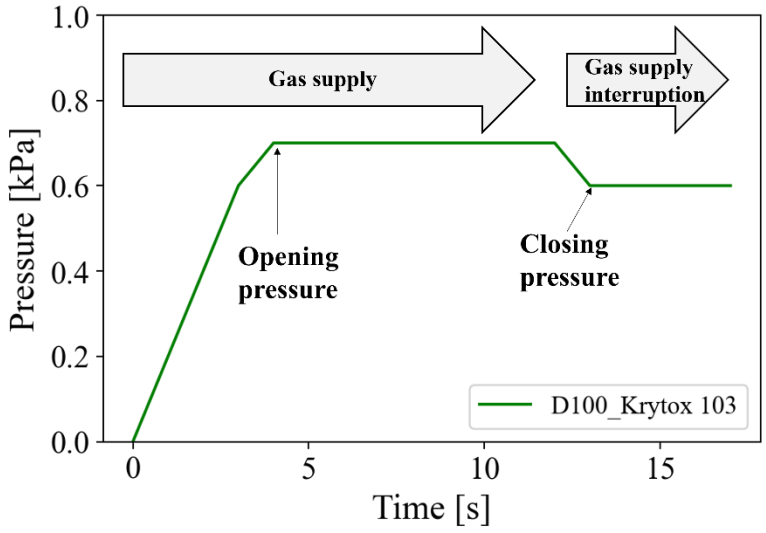

Figure S2. The measurement of the hysteresis between the opening pressure and the closing pressure of the OGIM.

Table S2. The opening pressure and the closing pressure of the OGIM.

	Opening pressure [kPa]	Closing pressure [kPa]	Hysteresis [kPa]
D100	0.7	0.63±0.05	0.05±0.05
D50	1.35±0.05	1.05±0.07	0.29±0.05
D40	1.55±0.05	1.33±0.047	0.18±0.06
D20	3.47±0.047	2.8±0.082	0.62±0.09

Table S3. Summarized kinematic viscosity of Krytox 103 and silicone oil 1000 cst from supplier data sheet.

Temperature	kinematic viscosity - Krytox 103	kinematic viscosity - Silicone oil
20℃	82 mm^2/s	1000 mm^2/s
40℃ for Krytox 103 50℃ for silicone oil	30 mm^2/s	600 mm^2/s
100℃	5 mm^2/s	30 mm^2/s

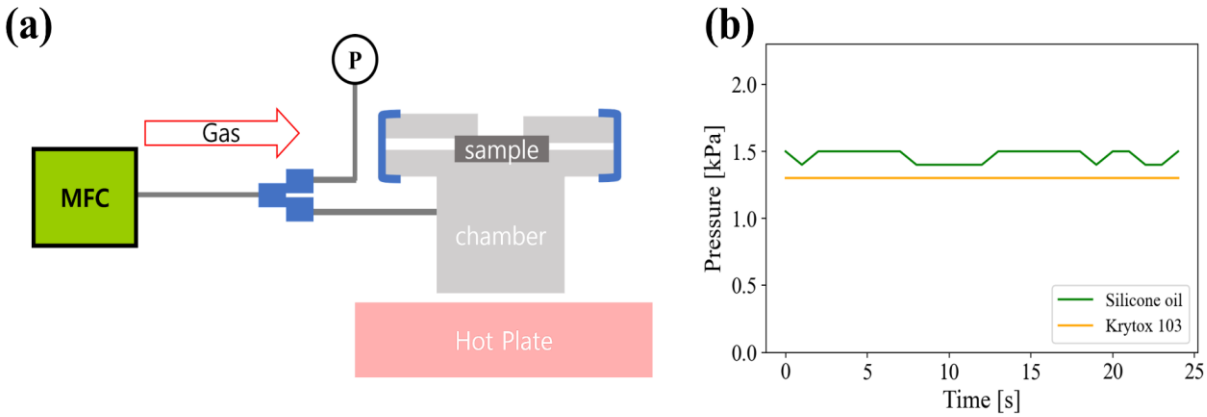

Figure S3. (a) Schematic illustration of the experimental set-up to investigate the impact of temperature on the pressure osciliating behavior of OGIMs (b) Measured internal pressure using the OGIM with the aperture diameter of 50 μm at 50℃. The green line represents the OGIM with silicone oil as a gating oil, while orange line represents the OGIM with Krytox 103 as a gating oil.

Table S4. Measured internal pressure using the OGIM with the aperture diameter of 50 μm by varying the temperature and the gating oil.

Temperature	Measured critical pressure - Krytox 103	Measured critical pressure - Silicone oil
25℃	1.35 kPa	0.5 kPa to 1.6 kPa
50℃	1.3 kPa	1.4 to 1.5 kPa

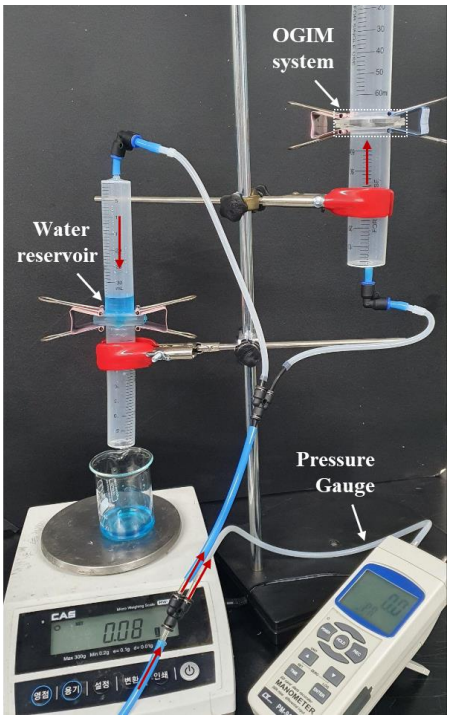

Figure S4. Camera image of experimental set-up for controllable pressure-induced passive flow regulator

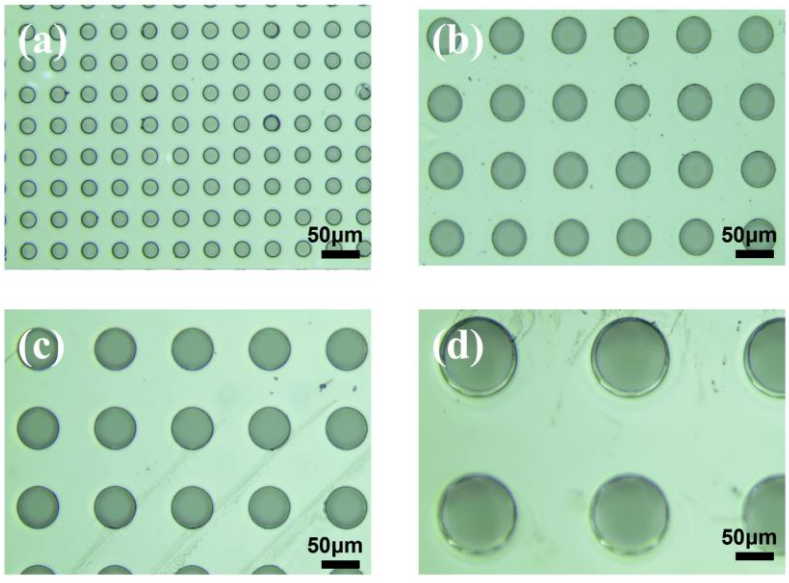

Figure S5. The OM images of PUA membranes with a diameter of (a) 20 μm (D20) (b) 40 μm (D40) (c) 50 μm (D50) (d) 100 μm (D100).

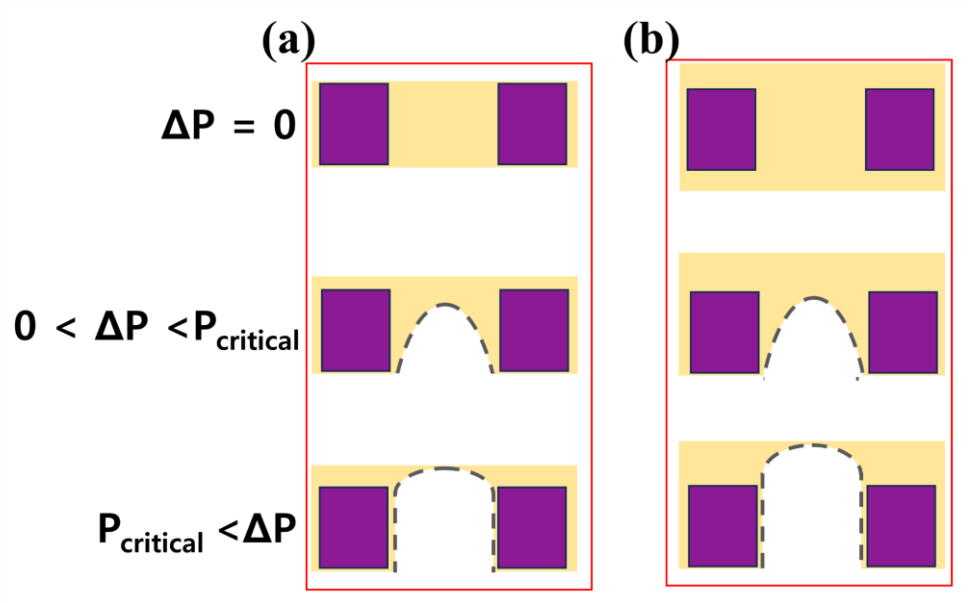

Figure S6. Schematic illustration of the opening behaviour of the OGIM dispensed with a variation of loading amounts of gating oil. (a) OGIM dispensed without excessive gating oil. (b) OGIM dispensed with excessive gating oil.

Table S5. Measured water flow rate and pressure for stencil membranes with different aperture size.

Sample	D20	D40	D50	D100
Pressure [kPa]	3.9±0.2	1.53±0.094	1.27±0.047	0.67±0.047
Water flow rate [ml/s]	0.048±0.004	0.022±0.002	0.018±0.001	0.012±0.001