Supplementary Information

Microfluidic-based redesign of a humidity-driven energy harvester

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AgCl formation

To form AgCl from Ag, we explored the appropriate conditions for the concentration of the sodium hypochlorite solution and processing time in advance using the following method. First, Ag ink (RA FS 059 S, Toyo Ink Co., Ltd., Japan) was printed on the entire surface of the glass plate (slide glass, Matsunami Glass Ind., Ltd., Japan) using a screen-printing machine (NT-15TVA, Neotechno Japan Corporation, Tokyo, Japan). The printed glass plate was heated in an oven at 130°C for 30 min, and then returned to room temperature. Sodium hypochlorite solutions (Fujifilm Wako, Osaka, Japan) diluted 4, 10, and 100 times were dropped onto the printed glass plate, and after standing for a certain period (10, 20, 30, 60, 120, 300, and 600 s), they were rinsed with pure water. The Ag that came into contact with the sodium hypochlorite solution turned discolored (Fig. S1). Longer contact with a more concentrated sodium hypochlorite solution (specifically, 120, 300, and 600 s of treatment using a 4-fold diluted sodium hypochlorite solution) resulted in more uniform discoloration without any defects. To confirm the formation of AgCl, the surfaces treated with a 4-fold diluted sodium hypochlorite solution for the surfaces treated for 120, 300, and 600 s were measured using an energy-dispersive X-ray spectroscopy detector pulse processing and control unit (x-stream-2, Oxford Instruments, UK) mounted on a microscope (TM4000Plus, HITACHI, Ltd., Japan). In both cases, approximately 20% of the mass was composed of Cl (Table S1). Based on these results, in this study, the dilution factor of the sodium hypochlorite solution was set to four, and the treatment time was set to 300 s.

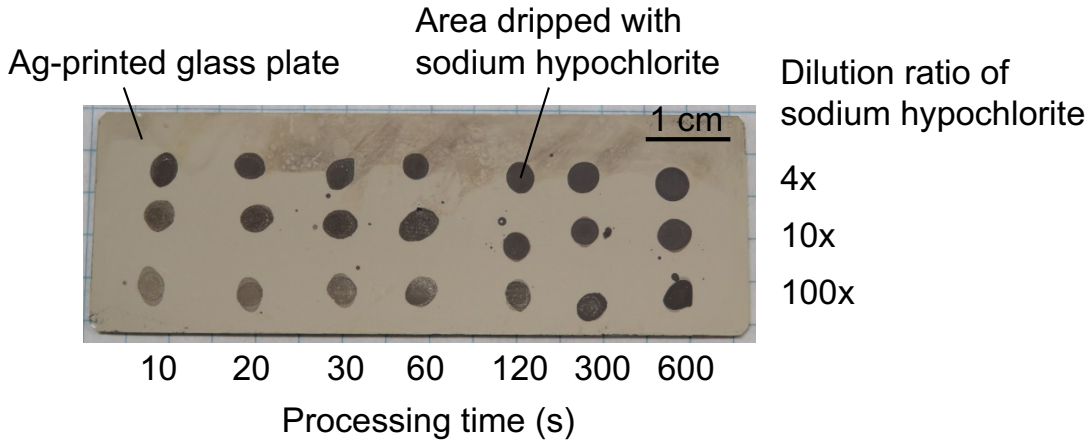

Fig. S1 Ag-printed glass plate treated with sodium hypochlorite under various conditions.

Table S1 Difference in the percentage of elements (Ag and Cl) by processing time using sodium hypochlorite solution.

	Mass percentage by element (%)	
Processing time (s)	Ag	Cl
0	82.9	0.2
120	62.0	18.6
300	78.5	21.5
600	62.9	20.9

Charged device connected to load resistor

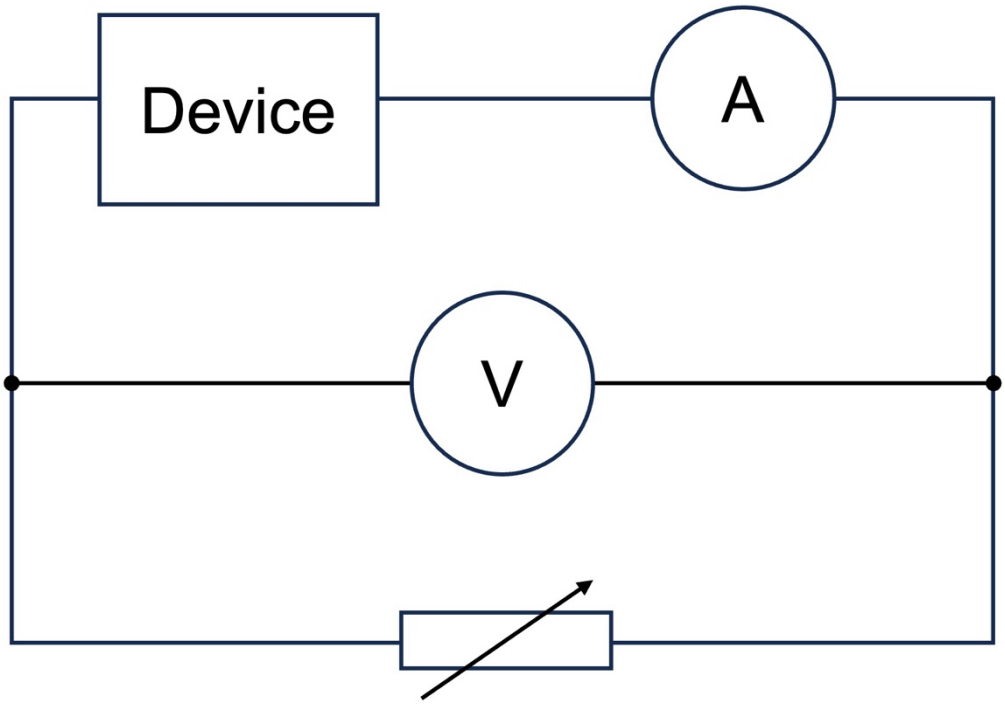

Fig. S2 Circuit used for power measurements.

Membrane separated by PDMS wall

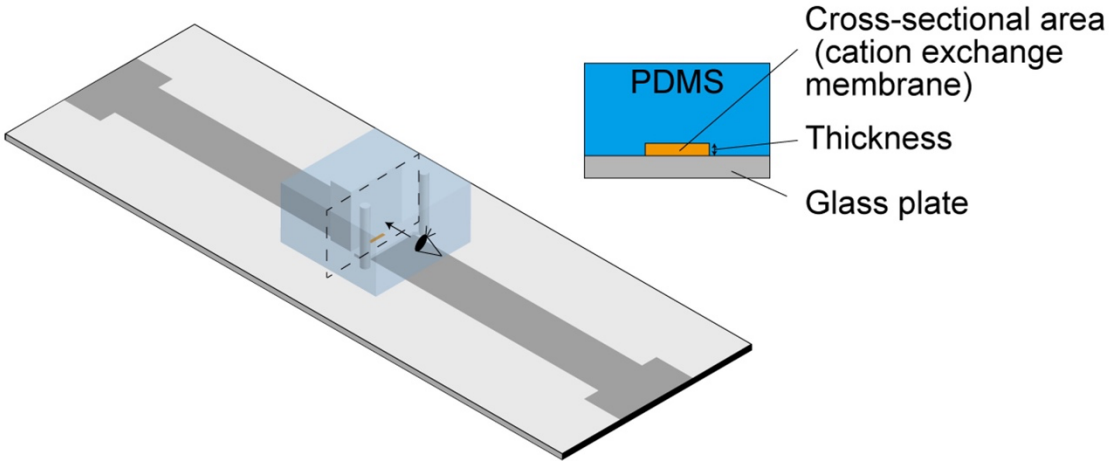

Fig. S3 Schematic diagram of membrane cross-section.