16-Channel Flow Cell for Nanopore Sensor

○Hai Huy Nguyen Pham[1], Itaru Yanagi[2], Ken-ichi Takeda[3]

Hitachi, Ltd., Research & Development Group, Center for Technology Innovation - Healthcare

E-mail: haihuy.nguyenpham.fp@hitachi.com

Solid-state nanopore has been attracting growing research interest owing to its potentials in biological sensing applications and its advantages in terms of robustness and possibility of a large-scale integration. When a nanopore-based sensing system is put into practical use, accuracy and measurement time are two important criteria. To increase accuracy and to reduce measurement time, an integration of nanopores and simultaneous measurement are an effective approach. Recently, we have developed 4×4 membrane arrays and demonstrated simultaneous detections of ionic-current blockades of the DNA translocation through two nanopores [1]. The simultaneous ionic-current measurement through 16 nanopores can be expected. However, there was a bottle neck of exploiting all 16 membranes owing to the lack of space to arrange flow paths to access to all membranes. Another bottle neck was the electrical conductance error caused by the generation of the air bubble between the membrane and the flow path.

In the present study, the mechanism of those issues is investigated, and a novel 16-channel flow cell made by a 3D printer is proposed and evaluated to exploit all of 16 membranes. The flow paths are arranged in both parallel and orthogonal direction to the membrane surface to access to all membranes. The adjustment of the position between the membrane surface and the position of aqueous solution emission from the flow path prevents the generation of the air bubble. Experimental results in Fig. 1 indicates that nanopores were successfully yielded in all 16 membranes by dielectric breakdown technique.

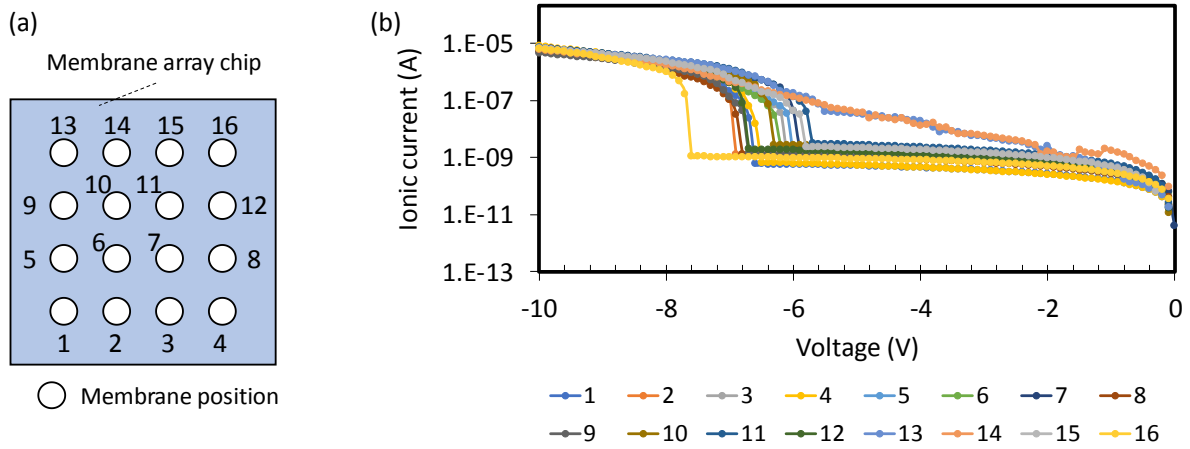

Fig. 1 Nanopore generation by dielectric breakdown technique for all 16 membranes using proposed 16-channel flow cell. (a) Schematic of membrane position. (b) Measured ionic-current during dielectric breakdown of each membrane.

References

[1] I. Yanagi et al., *Lap Chip* 16, 3340-3350, 2016; DOI: 10.1039/c6lc00639f.