

2 ステップ絶縁破壊によるナノポア形成

-薄膜部分の形成と該部分の貫通によるナノポア形成-

Two-step breakdown of a SiN membrane for nanopore fabrication:**Formation of thin portion and penetration**

○柳 至、濱村 浩孝、赤堀 玲奈、武田 健一

○Itaru Yanagi, Hirotaka Hamamura, Rena Akahori and Ken-ichi Takeda

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

E-mail: itaru.yanagi.yr@hitachi.com

For the nanopore sensing of various large molecules [1,2], such as probe-labelled DNA and antigen-antibody complexes, the nanopore size has to be customized for each target molecule. The recently developed nanopore fabrication method utilizing dielectric breakdown of a membrane is simple and quite inexpensive, but it is rather unsuitable for the stable fabrication of a single large nanopore due to the risk of generating multiple nanopores [3]. To overcome this bottleneck, we propose a new technique called “two-step breakdown” (TSB). In the first step of TSB, a local conductive thin portion (not a nanopore) is formed in the membrane by dielectric breakdown (Figure 1(a)). In the second step, the created thin portion is penetrated by voltage pulses whose polarity is opposite to the polarity of the voltage used in the first step (Figure 1(b)). By applying TSB to a 20-nm-thick SiN membrane, a single nanopore with a diameter of 21-26 nm could be fabricated with a high yield of 83%.

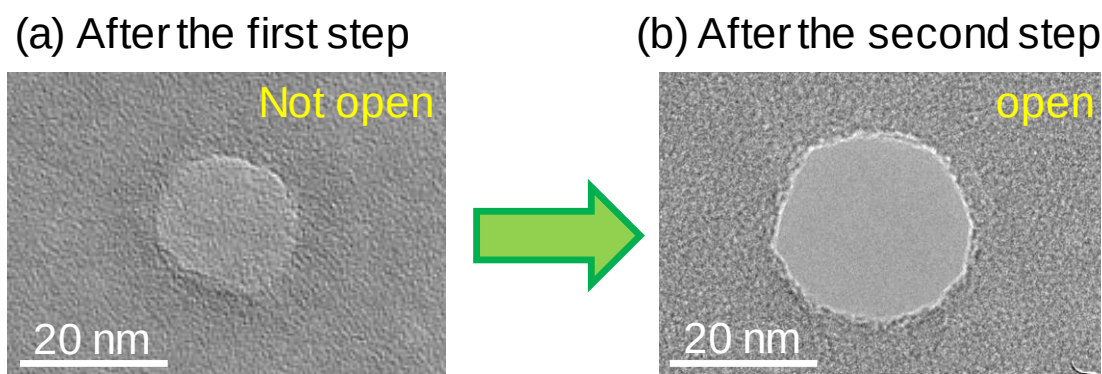


Fig. 1. (a) TEM image of a defect created in the SiN membrane after the first step of TSB.
(b) TEM image of a nanopore created in the SiN membrane after the second step of TSB.

References

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- [2] Morin, T. J. *et al.*, *PLoS ONE* **11**(5): e0154426. doi:10.1371/journal.pone.0154426 (2016).
- [3] Goto, Y., Yanagi, I., Matsui, K., Yokoi, T. and Takeda, K., *Sci. Rep.* **6**, 31324 (2016).