Nanochannel design for molecular separation on a free-standing ultrathin membrane

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Free-standing ultrathin membranes have attracted much attentions from both of fundamental and application aspects. Biological lipid bilayer membrane is an ideal example and has unique properties originated from its structural and material characteristics. Structural characteristics of a bilayer membrane are free-standing property with molecularly-thin thickness. Therefore, molecular scale phenomena and events become dominant in the thickness dimension. We recently succeeded to prepare free-standing nanomembrane with a centimeter-scale of lateral size. This membrane is manipulable macroscopically. Fusion of two different size scale (nano- and centime-scale) give new class of materials possessing both of nano- and macroscopic properties.
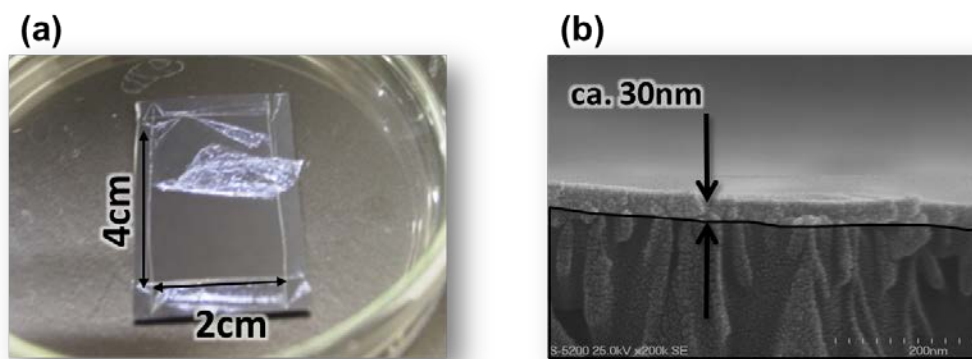

Figure 1. Free-standing nanomembrane (a) and its cross sectional morphology transferred on a porous support (b)

We have focused on the creation of free-standing and ultrathin films and on their functionalization,[1],[2] and have successfully prepared free-standing ultrathin nanomembranes with precise molecular filtration ability by designing nanochannels structures across a membrane. I will also discuss about the advantages of free-standing nanomembrane on the creation of selective molecular permeation. In addition, I will briefly show our achievements on the development of new type of fuel cell by using a nanomembrane with selective ion transportation properties.[3]

We believe that free-standing nanomembrane (nannometer thickness and large lateral size) would become new class of nanomaterials.

Reference

[1] S. Fujikawa, E. Muto, and T. Kunitake, *Langmuir* **2009**, 25(19), 11563-11568

[2] S. Fujikawa, E. Muto, and T. Kunitake, *Langmuir* **2007**, 23(8), 4629-4633.

[3] T. Kunitake, S. Fujikawa, *Nenryo Denchi* (燃料電池) 2010, 9(4), 73-78.