タンパク質による有機無機ハイブリッドナノ構造の作製

Organic and Inorganic Nanocomposite Structure Using Protein Moleculars

奈良先端大[1] ○(D)何超[1]，上沼睦典[1]，岡本尚文[1]，山下一郎[1]，浦岡行治[1]

NAIST[1], ○Chao He[1], Mutsunori Uenuma[1], Naofumi Okamoto, Ichiro Yamashita[1], Yukiharu Uraoka[1]

E-mail: h-chao@ms.naist.jp

To achieve nanoscale controlled structure, Bio Nano Process (BNP) has been proposed [1]. In the BNP, ferritin, which is consisted of 24 polypeptide subunits, is used to make nanocomposite structure. The inner and outer diameters of the ferritin protein shell are about 7 nm and 12 nm. We have been developing a process to make two dimensional array of ferritin on a surface [2]. On the other hand, introducing nanostructures is a novel way to optimize the thermoelectric properties for decreasing thermal conductivity. However, fabrication of fine nanostructures is still hard to be realized. Therefore, we have utilized BNP to fabricate organic nanostructure (low thermal conductivity) in inorganic materials. Iron-core ferritin and apo-ferritin were used to fabricate nanostructure in organic materials (silicon oxide). The process detail is that, at first, the samples were treated by UV-Ozone for 10 min at 115°C. Then, the ferritins were drop on the samples and spin coated. Finally, the silicon oxide thin film was fabricated on ferritins by electron beam evaporation. In order to evaluate the nanostructure, cross-sectional TEM image has been taken. From TEM image (Fig. 1), nanocomposite structure of ferritin within inorganic nanoparticles embedded in silicon oxide film (Fig. 1a) and nanostructure of apo-ferritin only embedded in silicon oxide film (Fig. 1b) can be observed, respectively. Therefore, nanocomposite structures with local nanosize protein spots were successfully fabricated by BNP.

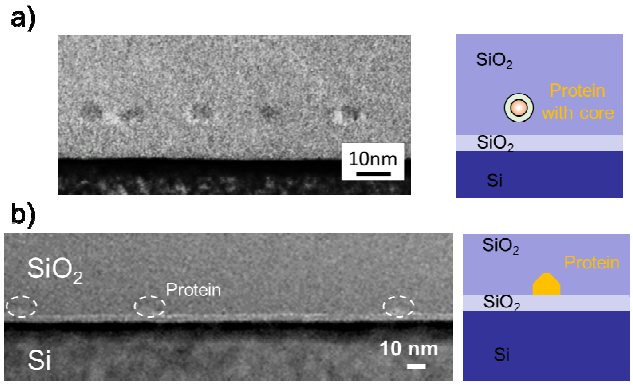

Figure 1: TEM cross-sectional image of a) protein with nanoparticles and b) protein only embedded in silicon oxide film and its schematic diagram.

References:

[1] I. Yamashita, Thin Solid Film. 393, 12 (2001).

[2] C. He, etc, Mater. Res. Express 1 045410 24 November (2014).