Fabrication of Alumina Nanotubes Using Anodic Porous Alumina from Al-Cr Alloys

T. Yanagishtia, K. Nishio, M. Nakao[+], A. Yokoo[+],
and H. Masuda*
Department of Applied Chemistry
Tokyo Metropolitan University
Hachioji, Tokyo 192-0397, Japan
[+]NTT, Atugi, Kanagawa, 243-01, Japan
*E-mail: masuda-hideki@c.metro-u.ac.jp

The geometrical structure of anodic porous alumina is schematically described as a hexagonally packed array of unifom sized cylindrical cells at the center of which a straight hole is located[1)]. Each cell in anodic alumian usually combines tightly and is difficult to fluctuated at the boundary of the cells. If each cell can be separated at its boundary and can be isolated each other, it is expected to form the uniform sized alumina nanotubes, which is useful for several kind of scientific and technological application fields. There have been few reports on the separation of the cells at their boundary[2,3)]. Under very limited anodizing conditions, fluctuation at the cell boundary takes place. Even in this anodizing condition, separation of the each cell is not easy, because the cells are combined each other.

In the present report, we describe the isolation of the cells of anodic porous alumina from Al-Cr alloy.

The experimental procedure is described schematically in Figure 1. Al alloy was anodized in phosphoric acid electrolyte. After the anodization the Al substrate was removed using saturated $HgCl_2$. Isolation of alumina tubes was carried out by ultrasonification.

Figure 2 shows a typical SEM micrograph of alumina tubes. Isolated uniform-sized alumina tubes can be observed. Using of the process of pretexturing[4)], the isolated alumina tubes with higher uniformity could be obtained.

The decrease of the binding force at the boundary of the cells in the anodic porous alumina from Al-Cr alloys can be interpreted based on the Cr enriched thin layer in aluminum oxide.

The present process is very simple and easy to prepare uniform alumina tubes. The obtained alumina nanotubes can be applied to several kinds of functional devices.

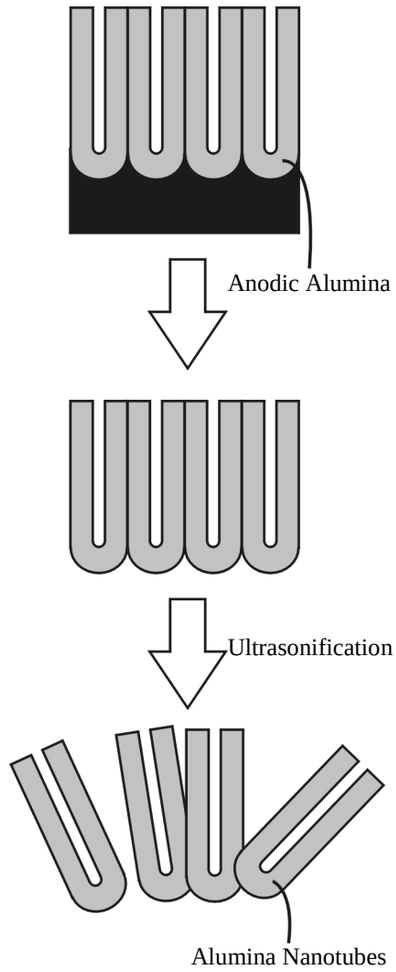

Figure 1 Schematic diagram of fabrication process

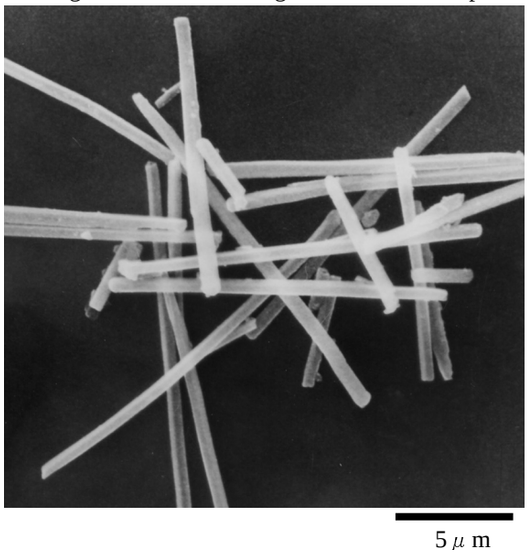

Figure 2 SEM micrograph of alumina tubes

Refarences

1)H. Masuda et al. Science, **268**, 1466 (1995)
2)H. Ginsberg et al. Metall, **17**, 202 (1964)
3) D. J. Arrowsmith et al. J. Mater. Sci. Ler., **5**, 921 (1986)
4)H. Masuda et al. Appl, Phys, Lett., **71**, 2770 (1997)