

## Fabrication of Accumulated Alumina/Ni Nanocable Structures from Anodic Porous Alumina

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Anodic porous alumina, a typical self-ordered nanochannel material formed by anodization of Al in an appropriate acid solution, has recently attracted increasing interest as a key material for the fabrication of nanometer-scale structures.<sup>1)</sup> In our previous report, we described the fabrication of alumina nanotubes with uniform sizes and shapes through the isolation of the cells of anodic porous alumina.<sup>2)</sup> This technique was based on the finding of unique properties of anodic alumina prepared from Al-Cr alloys. In addition, the alumina nanotubes filled with metal nanowire were also obtained easily. These nanocables with uniform sizes and shapes are promising as candidate building units for the ordered nanostructures by self-assembly. In the present report, we describe the fabrication of accumulated structures using alumina nanocables.

The experimental procedure is described schematically in Fig 1. The alumina nanotubes filled with Ni nanowire were used for the present study. After the electrodeposition of Ni into the holes of anodic porous alumina, isolation of each nanocable was carried out by ultrasonification in a solution. Self-assembly of nanocables from suspension was achieved in the electrochemical cell by using a permanent magnet placed under the electrode. The assembled nanocables were subsequently fixed on the electrode by electrochemical deposition.

Figure 2 shows a typical SEM micrograph of accumulated alumina nanocable structures after electrodeposition. It was confirmed that the nanocables were fixed vertically on the electrode. Angles of nanocables on the substrate could be controlled by magnetic force direction.

The present process has high controllability in preparing the self-assembled structures of nanocables on the substrate. The obtained structures can be applied to several kinds of functional nanodevices.

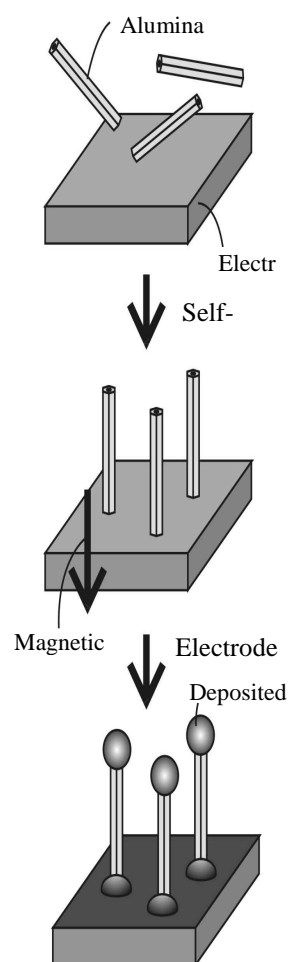


Figure 1. Schematic diagram of fabrication process

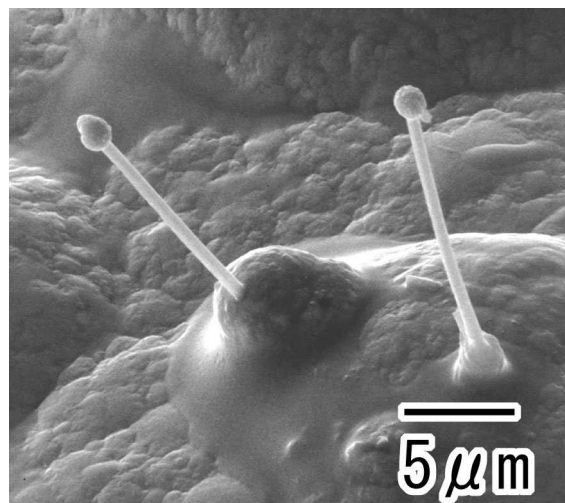


Figure 2. SEM micrograph of accumulated alumina nanocable structures

### References

- 1) H. Masuda and K. Fukuda, *Science*, **268**, 1466 (1995).
- 2) T. Yanagishita, K. Nishio, M. Nakao, A. Yokoo, and H. Masuda, 201th Meeting of The Electrochemical Society, Abstr. No. 323 (2002).