Silver Halide and Silver Formation In AAO Template

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Abstract

Well arrayed silver bromide wires were formed in anodic aluminum oxide (AAO) template. Then a photographic method was applied to this AgBr-AAO composite, and well arrayed silver filaments were formed in the pores in situ..

Experiment and Results Discription

Many kinds of nanowires such as metals, semiconductors and other compounds have been prepared because of their promising applications. Several methods have been reported for the synthesis and assembly of silver and silver halide wires based on anodic aluminum oxide (AAO) template [1, 2, 3]. In this paper, we prepared silver bromide wires in a AAO template and then introduce a photographic method for forming silver wires based on the AAO-silver bromide composite.

The fabrication method of silver bromide was similar as that for silver iodide introduced in reference 1. A perforated AAO membrane was used as the template. The pore diameter was 0.2 μm, and the AAO template thickness was 50 μm. A self-made glass cell was separated into two half cells by the AAO template. $AgNO_3$ and NH_4Br aqueous solutions were poured into each half-cell till the same liquid surface altitude. To prevent the one direction flow the porous template was pre-immersed in a dilute gelatin solution. The reaction time kept 0.5 to 4 hours at room temperature. During this period, silver and bromide ions would enter and meet in the AAO pores to form into AgBr wires.

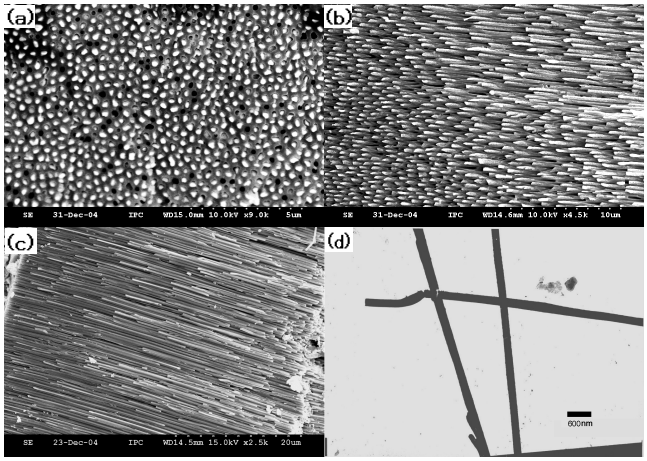

Figure 1 *The pictures of AgBr wires and AgBr-AAO composite. (a) The cross section of AgBr wires in AAO; (b) The tilted section; (c) The parallel section; (d) The TEM picture*

After preparation of the silver bromide, the AgBr-AAO composite was first exposed by a flash light and then developed with a photographic developer. To obtain in situ silver wires in the pores, the exposed AgBr-AAO composite should be reloaded into the glass cell, in which one half-cell loading with water and the other one loading with developer. The development kept 5 minutes to half an hour depending on the developer concentration. Finally, the developed composite was immerged into a $Na_2S_2O_3$ aqueous solution to remove the un-developed AgBr and washed with distilled water for SEM and TEM observation.

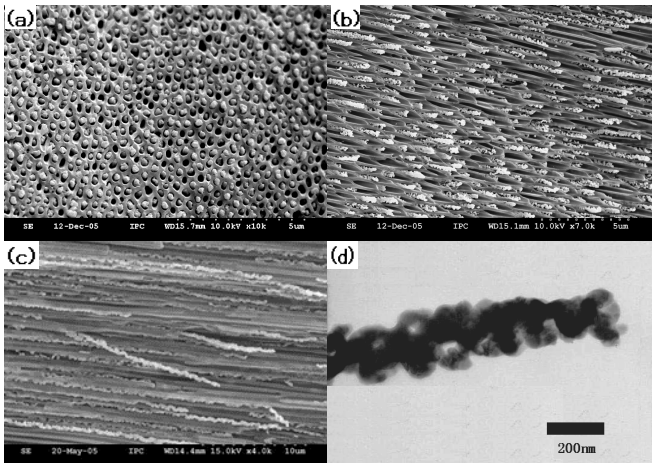

Figure 2 *The pictures of developed silver wires and Ag-AAO composite. The development was carried out after a flash exposure by day light. (a) The cross section of Ag wires in AAO; (b) The tilted section; (c) The parallel section; (d) The TEM picture Ag wires.*

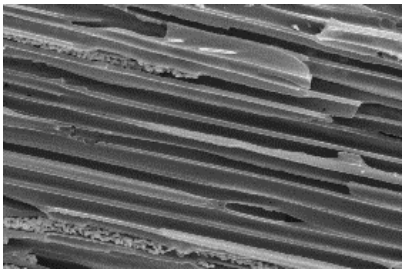

Figure 3 *The SEM picture of silver in AAO from the non-exposed AgBr-AAO composite.*

Figure 1 shows that well arrayed silver bromide wires were obtained, the wire diameters equal to that of AAO pores. By exposure, development and fixation, silver filament was obtained in the AAO pores (figure 2). Compared figure 2 to figure 3, it was observed that each pore filled with silver filament, while the silver wires in the un-exposed composite were much more exiguous than that in the exposed one. This means that a photographic method would be able to selectively produce silver wire arrays in AAO template.

References

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Author Biography

Jin-pei LI, associate professor, received his BS in chemistry from Sichuan University of China (1987). He has worked in Institute of Photographic Chemistry CAS till 1999, then the institute was combined into Technical Institute of Physics and Chemistry, CAS. His work focused on silver halide photography.

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