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A Simple Alternative of Barrier Layer Removal of Nanoporous Alumina Template on Silicon Substrate

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Abstract

Arrays of silicon nanowires are promising for opto-electronic[1] applications thanks to various unique properties such as quantum size effect. The vapor-liquid-solid (VLS) growth guided by anodic alumina oxide (AAO) has been preferably utilized because one dimensional nanostructures with controlled diameter and morphology are expected thanks to their confinement inside the self-organized vertical structure of self-ordered template[2]. However, the remaining oxidized barrier layer at the bottom of the pore often hampers electrochemical deposition of the metallic catalyst. As a consequence, a part of pores is free from the metallic catalyst, and the density and distribution of Si nanowires are limited to be modest.

In this contribution, we propose an alternative method for effective barrier layer removal which includes the control of the adhesion of aluminum on silicon substrate. In fact, only 10nm insertion of aluminum thin film at low deposition rate by thermal evaporation before thickening by sputtering deposition was found to be effective to remove the barrier layer. This was evidenced by comparison of plating currents during electrochemical gold plating to AAO with and without insertion of the 10nm-thick Al layer deposited at low deposition rate. In addition, the coverage of plated gold reached 80% for AAO with insertion of 10nm-thick evaporated Al layer, which is almost twice for AAO without the 10nm-thick Al layer.

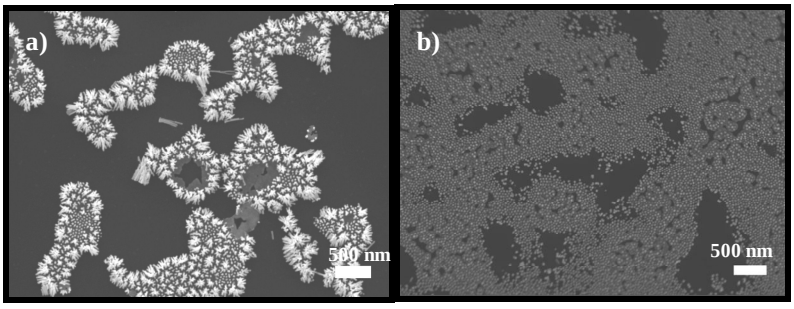

Figure 1a, b: *SEM images depicting gold plating distribution after etching away AAO without and with insertion of 10nm thick Aluminum layer*

[1] JeeEun Yang, Chang-Beom Jin, CheolJoo Kim, Moon Ho Jo, Nano Letters, **6**(2006) 2684, *Band gap modulation in single crystalline Si1-xGex nanowires.*

[2] T. Shimizu, S. Senz, S. Shingubara, U. Gösele, *Synthesis of epitaxial Si(100) nanowires on Si(100) substrate using vapor–liquid–solid growth in anodic aluminum oxide nanopore arrays*, Appl. Phys. Mater. Sci. Process. 87 (2007) 607–610.