POROUS ALUMINA IN THE CONTROL OF POSITION AND SHAPE OF NANOSTRUCTURES.

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Synthesis of nanostructures with control of size, shape and location is a critical goal to obtain better and novel features in advanced devices. In this presentation, brief summary on the possibility to use porous alumina properties in this purpose is shown. For that, two different approaches are used: a) porous alumina as a template in the electrodeposition of nanowires arrays and b) the use the self-ordering process of porous alumina to pre-patterned large area substrates.

In the first approach, an aluminum foil is polished mechanically and electrochemically, and then anodized in 0.3 M oxalic acid (2 °C) at 40 V. This process yields films of porous Al_2O_3 with 40 nm diameter pores. Approximately 1 μm of Ag is sputter-deposited on the top face of the template to serve as the conducting surface of the electrode. The Al foil /alumina /Ag composite was soaked in a saturated $HgCl_2$ solution to remove the remaining Al from the bottom side. The barrier layer of Al_2O_3 just above the Al was removed by dissolution with a saturated solution of KOH in ethylene glycol. This template are use in the electrodeposition of different materials and by understanding the wetting/non-wetting behaviour of the alumina different structures in the nanowires can be obtained, different examples will be shown: sinusoidal, core-shell, etc.[1,2]

The second approach lies in using a crystalline epitaxial aluminium layer grown on GaAs (001) and Si (001) substrates by molecular beam epitaxy (MBE) or by metal evaporation as starting point for porous alumina fabrication. This layer is anodized electrochemically. By this process, we obtain a substrate with a monolithically integrated nanoporous alumina mask on top. If the process continues after all the Al is consumed a nanohole array can be develop on the substrate surface. This nanohole array can be used as preferential nucleation centres for QD formation.[3] The different conditions to control dot position will be shown.

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References

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