

Contribution ID: 1815
compétition)Type: **Poster (Student, In Competition) / Affiche (Étudiant(e), inscrit à la**

POS-14 - Nano-antenna fabrication through porous anodic alumina template

Wednesday 31 May 2017 18:30 (2 minutes)

According to recent developments in nanotechnology, the fabrication of nanostructures such as nano-particles (NPs), nano-rods (NRs), and nano-tubes (NTs) have been intensified, which have wide range of applications in electronic, magnetic, optical and energy storage devices. Various processing methods are used such as lithography and porous templates among which porous anodic alumina (PAA) membranes are the most widely used templates. PAA template is self-organized nano-channels with a high degree of arranged nano-pores formed by electrochemical anodization, fabricated in acidic electrolyte. Nano-structure synthesis is achieved by filling the pore channels either by soaking the membrane in appropriate precursor solutions or by electrodeposition process. In our project, using a PAA template, which has a barrier layer, to fabricate an array of optical nano-antennas is a big challenge due to its electrical insulation. Moreover, the use of commercial alumina membrane on free-substrates is not efficient due to the lack of controllability on its specifications, such as the pore's sizes and interconnected channels. So, we made the barrier layer thickness very thin, at the end of the anodization process by controlling the applied voltage. We could also control the depth and radius of pores to match specified requirements. Actually, the aspect ratio of optical nano-antenna is very crucial to have resonance at various light spectrums. Then we could detach the PAA membrane from the bulk Aluminum by dissolving the remaining metal in Mercuric chloride (HgCl_2). After opening the bottom of the pores and sputtering a thin layer of gold as an electrode, it used as a template for the nano-rods growth on top of the conductive substrate. An array of Ag or Au nano-antennas will be developed with uniform size and length through this template as an inexpensive and reproducible process to be used in the large-area fabrication of Rectenna (rectifying antenna) solar cells.

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Session Classification: DAMOPC Poster Session | Session d'affiches DPAMPC (14)

Track Classification: Division of Atomic, Molecular and Optical Physics, Canada / Division de la physique atomique, moléculaire et photonique, Canada (DAMOPC-DPAMPC)