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Engineered Nanoporous anodic alumina photonic structures

Nanoporous anodic alumina (NAA) is a self-assembled porous material with a hexagonal pattern having a characteristic interpore distance and pore diameter that can be tuned in the range of 30 nm- 800 nm and 10 nm - 300 nm respectively under specific fabrication conditions [1]. Optical and photonic properties such as reflectance, transmittance, absorbance and photoluminescence can be structurally engineered by modifying the effective medium of these nanoporous materials [2,3].

It has been shown that these porous structures possess photonic bands for light propagating perpendicularly to the pores [4].

In this work, we present recent results in the design and fabrication of photonic nanostructures based on nanoporous anodic alumina. We introduce different electrochemical approaches to modify the pore morphology during or after the electrochemical processes [5]. Figure 1 shows an example of top view scanning electron microscopy (SEM) image of self-ordered NAA.

We engineered and analyzed different kinds of nanoporous photonic structures such as distributed Bragg reflectors, microcavities, rugate filters, etc. Figure 2 shows the reflectance spectra of two sets of NAA samples (green and red range) for four different pore diameters.

Finally, we discuss about the future and potential applications of these nanoporous structures in areas such as biosensing, photonic tagging, environmental monitoring, energy, and drug screening.

References

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Figures

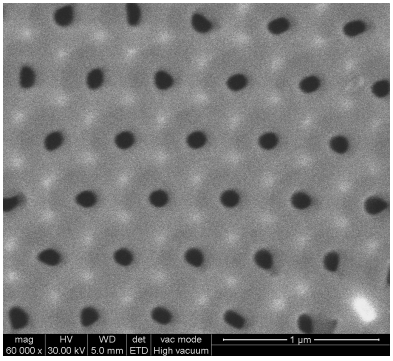

Figure 1: Example of top view SEM image of self-ordered nanoporous anodic alumina. The pore diameter is 95 nm.

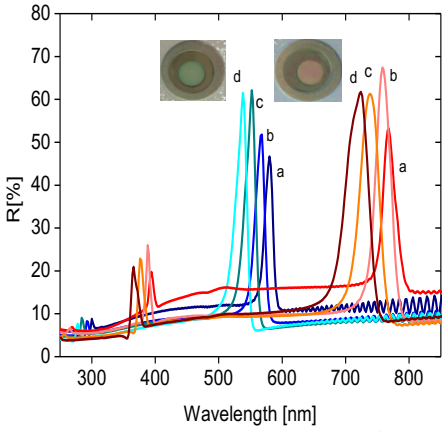

Figure 2: Reflectance spectra of two sets of NAA samples (green and red range) for different pore diameters: a) 38 nm, b) 42 nm, c) 46 nm and d) 50 nm. Inset: digital images of the NAA samples.