Developing optical structures based on nanoporous anodic alumina for biomedical applications

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Nanoporous anodic alumina (NAA) is a popular porous material obtained by the electrochemical anodization of aluminum. NAA is based on a cost-effective technology and their structure presents a self-ordering defined by a close-packed hexagonal array of well-defined cylindrical nanopores. NAA's versatility and potential are demonstrated by its impressive set of properties, which include nanopores with high aspect ratio, optical properties, chemical resistance, thermal stability, and intrinsic photoluminescence [1-3].

Their geometric characteristics such as pore diameter and length and interpore distance can be precisely determined by the anodization conditions such as voltage and time of anodization, temperature, and electrolyte and by post-anodization treatments (etching and annealing) [4-5]. The highly effective surface area (hundreds of m^2/cm^3) makes of NAA an interesting platform for sensing and loading and releasing of active agents [6-7]. Recently, different anodizing approaches have been proposed to create new structures and pore geometries. The application of periodic variations of current or voltage (square, sinusoidal, Gaussian waves) during anodization transfers to the material as a periodic variation of the pore diameter, and consequently, it is possible to design 3D structures and photonic structures with stop bands tunable within the UV-VIS-NIR range [7-9].

This work will focus on recent advances in the design and fabrication of NAA and their photonic and optic applications as optical biosensing. We will analyze different technological parameters and its effect on the structure and present examples of biosensing based in reflectometric interference spectroscopy, surface plasmon resonance, Tamm plasmon resonance, photoluminescent spectroscopy and surface-enhanced Raman scattering [10-11]

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Figures

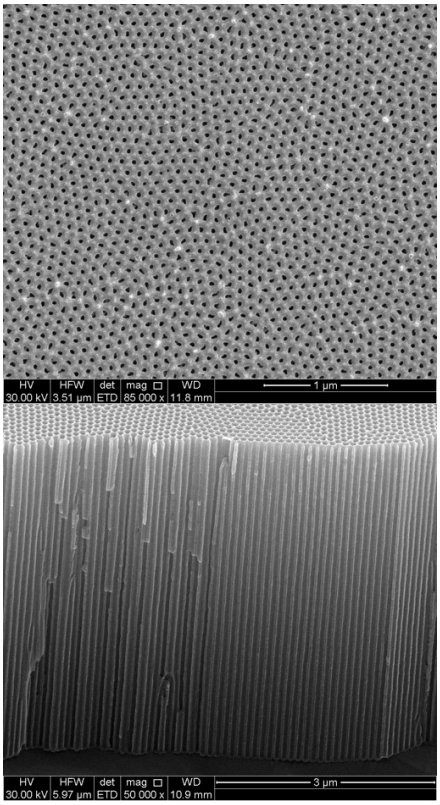

Figure 1. Field Emission Scanning Electron Image of a top view (up) and cross section view (bottom) of a NAA structure.

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