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Recent advances in nanoporous anodic alumina for sensing and drug delivery applications

Nanoporous anodic alumina (NAA) is a nanostructured material that under specific conditions, their structure presents a self-ordering defined by a close-packed hexagonal array of parallel cylindrical nanopores [1]. By controlling anodization conditions, its porous geometry can be modified, for example the diameter of the nanopores can be tuned from 10 nm up to 400 nm. NAA presents an outstanding set of properties (good mechanical and chemically stability, photoluminescence, large effective surface area-hundreds of m^2/cm^3) and is obtained by a cost-effective fabrication processes [2]. In addition, its chemical surface functionalization makes of NAA an excellent candidate for biosensing platforms and drug delivery systems [3-4].
In this context, we will present some recent advances in the design and fabrication of NAA structures and introduce different electrochemical approaches to modify the pore geometry during or after the fabrication processes. Some examples of optical NAA structures (microcavities, Bragg reflectors, graded refractive index) [5] and surface functionalization are presented (figure 1) and analyzed as examples of sensitive biosensing. Finally, 2D and 3D pore geometries of nanoporous anodic alumina are presented for efficient sustained drug release platforms [6]. Moreover, examples of surface functionalization for a controlled and stimuli-responsive drug release (figure 2) is presented and discussed.

References

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Acknowledgements

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Figures

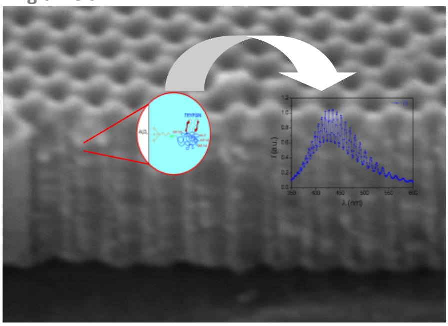

Figure 1: Cross-section SEM image of NAA. Inset: schematic illustration of the chemical functionalization of the pore surface and reflectometric interference spectroscopy spectrum of NAA. Pore diameter ≈ 45 nm.

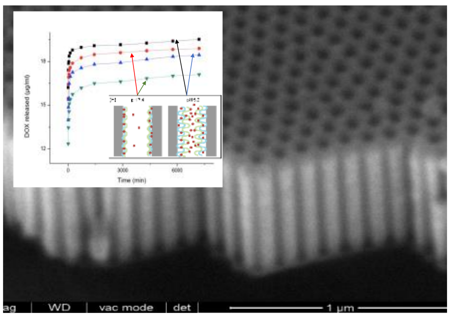

Figure 2: SEM image of NAA. Inset: DOX release at pH 5.2 and 7.4 for NAA (black and red symbols) and NAA coated with a PH stimuli-response polyelectrolyte (blue and green symbols).