Structural Design and Biotecnological Applications of Nanoporous Anodic Alumina

Josep Ferré-Borrull, Laura Pol, Chris Eckstein, Laura K. Acosta, Elisabet Xifre-Pérez, Lluis F. Marsal

Universitat Rovira i Virgili, Nano-electronics and Photonic Systems Group (NePhoS)
Avinguda Paisos Catalans 26, Tarragona, Spain
josep.ferre@urv.cat

Nanoporous Anodic Alumina (NAA) is a material with great versatility and low-cost and scalable production. In the last years, the group NePhoS led by Prof. Lluis F. Marsal has reached a high level of expertise on the preparation of such material and its application to health, energy and environment., as it has been reported in previous communications to Nanospain. In this communication we aim at introducing the latest advances in structural design of NAA and its application to the biotechnological domain. Structural desing refers to providing different function to the basic porous oxide material through changes in the structure during production and engineering of its optical properties.

One of the applications of NAA is the development of a nano-opto-fluidic method to detect changes on the geometry or the surface properties of the pores in NAA[1,2], which permits the detection of the binding of different proteins to the pore walls. The second example shows that the precise control of the fabrication parameters permits the achievement of rugate filters with photonic stop bands that can be applied to biosensing [3,4]. Finally, we show the ability of NAA to monitor in real time the attachment of different biomolecules to the pore walls by means of an optical spectroscopy method and adequate post-processing.

References

[1]   C. Eckstein et. Al., Langmuir, 32 (2016) 10467
[2]   C. Eckstein et al., ACS Appl. Mater. Interfaces, 10 (2018) 10571
[3]   G. Macias et al., Nanoscale Research Letters, 9 (2014) 315
[4]   L. K. Acosta et al., ACS Appl. Mater. Interfaces, 11 (2019) 3360
[5]   G. Macias et al., Analyst, 140 (2015), 4848
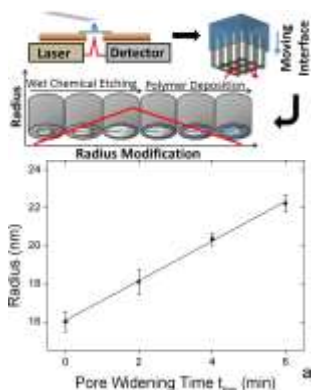[6]   L. Pol et al., Nanomaterials, 9 (2019), 478

Figures

Figure 1: Fluid Imbibition-coupled interferometry (FICLI).
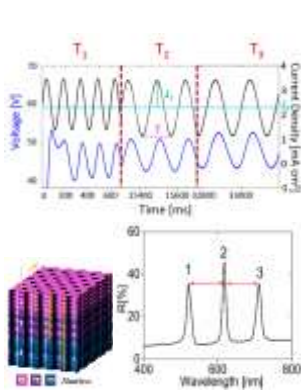

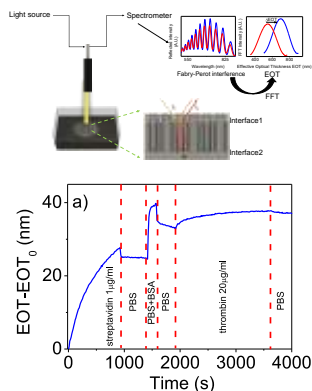**Figure 2:** Stacked rugate filters with tunable high reflectance stop bands.

Figure 3: Reflection Interference Spectroscopy (RIfS) for real time monitoring of molecule interaction.