Engineering of Nanoporous Anodic Alumina Photonic Crystals and Sensing Applications

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Nanoporous anodic alumina (NAA) produced by anodization of aluminium is an emerging platform material for developing multi-dimensional photonic structures due to its well-established, cost-effective and industrially scalable fabrication process – compatible with conventional micro and nanofabrication. The outstanding set of properties of NAA such as self-organized nanoporous structure, straight cylindrical nanopores of high aspect ratio, optical properties, chemical resistance and thermal stability and intrinsic photoluminescence demonstrate its versatility and potential [1-2]. On important feature is the highly controllable and versatile nanopore geometry by adjusting their anodization conditions such as electrolyte concentration, current/voltage supply, time, and temperature [3-4]. Recently, different anodization approaches have been proposed to create new structures and pore geometries. In particular, applying of periodic variations of current or voltage during the anodization, we can produce periodic variations of the structure of porous and consequently, it is possible design, 3D structures and photonic structures with stop bands tunable within the UV-VIS-NIR range [5-6].
In this presentation, we will introduce recent advances in nanoporous anodic alumina technology, including the development of high-quality forms of NAA-based photonic crystals and their application in sensing substances of interest to the health and the environment.

References

[1] Santos, A., Vojkuvka, L., Alba, M., Balderrama, V.S., Ferré-Borrull, J., Pallarès, J., Marsal, L.F. (2012) Physica Status Solidi (A) Applications and Materials Science, 209 (10), 2045-2048.
[2] Santos, A., Ferré-Borrull, J., Pallarès, J., Marsal, L.F. (2011) Physica Status Solidi (A) Applications and Materials Science, 208 (3), 668-674.
[3] C Lim, S.Y., Law, C.S., Bertó-Roselló, F., Liu, L., Markovic, M., Ferré-Borrull, J., Abell, A.D., Voelcker, N.H., Marsal, L.F., Santos, A. (2020) Catalysis Science and Technology, 10 (10), 3195-3211.
[4] Law, C.S., Lim, S.Y., Liu, L., Abell, A.D., Marsal, L.F., Santos, A. (2020) Nanoscale, 12 (17), 9404-9415.
[5] Acosta, L.K., Bertó-Roselló, F., Xifre-Perez, E., Santos, A., Ferré-Borrull, J., Marsal, L.F. (2019) ACS Applied Materials and Interfaces, 11 (3), 3360-3371.
[6] Acosta, L.K., Bertó-Roselló, F., Xifre-Perez, E., Law, C.S., Santos, A., Ferré-Borrull, J., Marsal, L.F. (2020) ACS Applied Materials and Interfaces, 12 (17), 19778-19787.

Figures

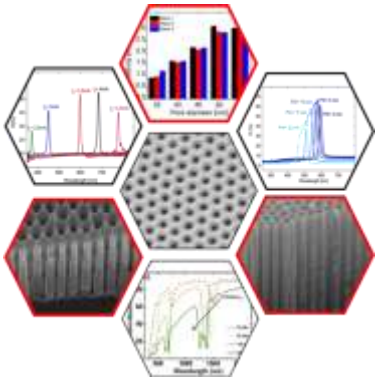

Figure 1. Examples of self-ordered nanoporous anodic alumina and photonic stop bands