

# Low-cost Nanotechnologies for Biosensing

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## IEEE Hamilton Section Distinguished Lecture

This talk will explore the application of low-cost technologies based on micro- and nanoporous silicon and nanoporous alumina in biosensors. The structural engineering of porous silicon and alumina and its surface and interface functionalization in the micro-nanoscale regime allow for development of new optical biosensing platforms.

In this presentation, we present different electrochemical approaches to modify the pore morphology during or after the fabrication processes (e.g. straight and well-defined pores, cone-like, funnel-like, modulated, hierarchical, three-dimensional, tip-like, etc.) and we design and fabricate specific structures with enhanced optical response such as tunable porous microcavities, gold-coated nanoporous bilayers, porous distributed Bragg reflectors, nanoporous rugate filters, etc. Following, we analyze and discuss different techniques of detection such as reflectometric interference spectroscopy, photoluminescent spectroscopy and test its performance in the detection of proteins, enzymes, molecules and heavy metal ions. Finally, we discuss some future biomedical applications such as novel engineered drug delivery systems and micro-nano-engineered cellular microenvironments for 3D cell cultures and tissue engineering.



Lluís F. Marsal is Full Professor at the Department of Electronic, Electric and Automatic Engineering of the Universitat Rovira i Virgili, Spain. He obtained his Ph.D. degree in Physics in 1997 from the Universitat Politècnica de Catalunya. Between 1998 and 1999, he was postdoctoral researcher at the Department of Electrical and Computer Engineering, University of Waterloo, Ontario, Canada.

In 2012 he received the URV's RQR Award for quality in research and in 2014, he received a 2014 UniSA Distinguished Researcher Award from the University of South Australia (UniSA) and the ICREA Academia Award from the Generalitat of Catalunya. Since 2013, he is the Chair of Spain Chapter of the IEEE Electron Devices Society. He is a senior member of the Institute of Electrical and Electronics Engineers (IEEE) and of the Optical Society of America (OSA) and also an active member of the Electrochemical Society (ECS). Dr. Marsal serves as a member of the Distinguished Lecturer program of the Electron Devices Society (EDS-IEEE) He has been member of advisory and technical committees in several international and national conferences and has been visiting professor at several universities and research institutions.

Dr. Marsal has co-authored more than 200 publications in international refereed journals and conferences, 2 books, 5 book chapters and holds two patents. He has presented over 20 invited lectures in international conferences and has participated in over than 80 national and international projects. His current research interests mainly focus on low-cost technologies based on micro- and nanoporous silicon and nanoporous alumina for biomedical applications and optical biosensing platforms. He is also interested in organic and hybrid nanostructured materials to enhance light-matter interactions for optoelectronic devices.