NETPORE
Network on porous semiconductors and oxides

PRESENTER INFORMATION

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BIOGRAPHICAL SKETCH

Joan J. Carvajal is Bachelor (1997), and PhD in Chemistry (2003) from University Rovira i Virgili (URV), Spain, post-doctoral Fulbright fellow (2004-2006) at Stony Brook University, USA, Ramon y Cajal researcher (2006) and Associate Professor (2011) in Materials Science (URV).
He co-authored more than 225 papers in international journals, and 3 book chapters with a good number of citations that allowed to obtain a h index of 24. His research is focused on developing luminescent materials and nanoparticles for different applications, mainly nanothermometers operating in the biological windows through new interrogation schemes and combined with photothermal properties, porous wide bandgap semiconductors, new mechanisms for the generation of up-conversion emissions in highly doped lanthanide based nanoparticles, and new roles of lanthanide ions as energy reservoirs, among others. He is also Visiting Professor at the Harbin Engineering University (China) since 2019.
He supervised 8 PhD Thesis about integrated photonics, structuration of optical materials for diffraction gratings, down-shifting to improve efficiency in polymeric solar cells, porous GaN and luminescence nanothermometry. At present he is supervising 2 PhD Thesis on measuring the impact of training programs for doctoral supervisors, and on the use of carbon dots as luminescent sensors.
He has been very active in the dissemination of science in general, and the research developed to society.
He is the Vice-dean of the Faculty of Chemistry of the URV since 2014. He is also founding member of the Group of Trainers for the Professionalization of the Doctoral Supervision at the URV, with whom designed and taught training programs for doctoral supervisors and doctoral candidates to increase the awareness of the responsibilities and roles that the doctoral supervisor is playing, and how to take the most advantage of the doctorate process. These workshops have been taught in more than 50 universities in Spain, Europe and Latin-America, training more than 1,000 supervisors and 1,500 PhD candidates.
He has been co-coordinating the projects “Científiques: passat i present!” (http://cientifiques-stem.cat/) devoted to give visibility to women scientists through educational material for senior elementary school students, and “La Química a Tarragona: Elemental!” (http://www.taulaperiodica-stem.cat/) to commemorate the 150th anniversary of the Periodic Table of the Elements, involving high-school students, university, and industry. A part from that, he published more than 10 papers of scientific dissemination in non-specialized magazines in Spain.

TITLE: **Rectifiers, MOS diodes and LEDs made of fully porous GaN produced by Chemical Vapor Deposition**

ABSTRACT

GaN is an important wide band-gap semiconductor in electronics and optoelectronics. In its porous form is particularly interesting for developing optoelectronic devices with improved efficiency, such as LEDs with enhanced efficiency and sensors with enhanced sensitivity.

Through chemical vapour deposition (CVD), we have shown that it is possible to produce nanoporous GaN without any etching or chemical post-growth treatment, with the porosity being present only on the (0001) face of the material. Low resistivity ohmic Pt and Au metallic contacts were demonstrated on porous n-type GaN by the formation of intermetallic seed layers through the vapour-solid-solid (VSS) mechanism. Also, we have been able to develop p-type porous GaN by doping with Mg, with a charge carrier concentration of the order of 10^{18} cm^{-3}. By tuning the concentration of Mg, introduced as Mg_2N_3 in the CVD system, it has been possible to form a polycrystalline high-κ oxide between an ohmic metallic alloy interlayer contact and the porous GaN, while maintaining a clean interface, that allowed to fabricate a MOS-type diode on silicon in a single growth regime.

Through the careful selection of the substrate it has also been possible to produce porous GaN epitaxial layers that allow for the fabrication of high quality partially and fully porous GaN rectifying p-n junctions, through a two step CVD process, and show their behaviour as diodes with effective uniform conduction under a green technology. Here, we will also present the recent results we obtained in the light emission of these structures, as well as their optical, structural, and tailored wettability properties.

These porous junctions have potential applications in high brightness unencapsulated LEDs with enhanced light emitting properties and high surface area sensors with improved sensitivity.