AYUDAS RAMÓN Y CAJAL
CONVOCATORIA 2015

Turno de acceso general

Nombre: **GÁNDARA BARRAGÁN, FELIPE**
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Área Científica: Ciencia y Tecnología de Materiales
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Título:

Synthesis, characterization and properties of functional materials

Resumen de la Memoria:

My research line is related to the preparation, characterization and evaluation of properties of functional materials. In particular, I work with a class of materials known as metal-organic frameworks (MOFs), and related ones. MOFs are a kind of crystalline materials made of the joining of metal clusters and organic linkers, resulting in structures with high surface area and porosity. Due to their high porosity and structural variability, MOFs have found numerous applications in fields such as catalysis, gas storage and separation, optoelectronic, or drug delivery, among others. During my PhD stage, I focused my thesis on the preparation of rare-earth based MOFs for various applications. Thus, I prepared several families of new MOFs, which showed high activity and selectivity as heterogenous catalysts in different important organic transformations, such as oxidation of sulfides, or desulphurization reactions. I was also interested in the structural analysis of these materials, including their topological features. Through the study of the topological characteristics of MOFs, it is possible to design new materials with adequate features for desired applications. For example, it was possible to prepare several MOFs based on rare-earth elements, where these atoms where conveniently disposed in the structure of the MOF to enhanced their luminescence properties avoiding self-quenching phenomena, and allowing doping with desired elements to tune the resulting emission properties. Upon completion of my PhD, I moved first to the University of California, Los Angeles, and then to UC Berkeley, to work in a leading group in the field. There I continued working with MOFs materials, but now with interest in their gas sorption and electric conduction properties for their use in energy storage applications. Thus, I developed different materials able to combine high surface area with intrinsic electric conductivity. I was also interested in the design of materials able to storage methane, and I prepared some MOFs showing vey high methane volumetric storage capacity. These materials are useful for the storage of natural gas for on board applications. I was also involved in other projects relevant to clean energy applications, such as carbon dioxide capture or water sorption for thermal batteries. During this time, I also developed an expertise in the structural characterization of this and other classes of complex materials, through the combination of different techniques, such as x-ray diffraction, electron microscopy, and computer simulations. After 4.5 years in USA, I returned to Spain, where I am now leading research lines focused on the preparation of heterometallic MOFs and on the discovery of new MOF-related materials with the use of elements that are currently underexplored. Thus, I am studying MOFs materials that are susceptible to accommodate different metal elements in the same position of their crystalline framework. This is relevant, for example, for the preparation of materials with tunable catalytic activity in multicomponent reactions, or for the preparation of materials with enhanced electric conductivity.

Resumen del Currículum Vitae:

Dr. Felipe Gándara is currently a researcher at the Materials Science Institute of Madrid (ICMM – CSIC). He graduated in 2003 from the Universidad Autónoma de Madrid (UAM), and started his career at the Spanish CSIC, first as an I3P-CSIC postgraduate fellow, and then as a FPI PhD student. Upon completion of his PhD thesis in 2009, receiving the UAM special doctorate award, he accepted an offer from Prof. O. M. Yaghi to work in his group at the University of California, Los Angeles as a post-doctoral associate. During this period he also received a post-doctoral scholarship granted by the Spanish Ministry of Education. In 2012 he moved along with the Yaghi group to UC Berkeley, where he was responsible for setting up and managing the group laboratories, being principal investigator of the x-ray diffraction lab of the group in the Lawerence Berkeley National Laboratory. During this time, he also mentored several graduate students and post-docs. He stayed at Berkeley until April 2014 (total 4.5 years abroad), and returned to Spain as a Juan de la Cierva scholar, joining the department of New Architectures in Materials Chemistry at ICMM – CSIC. Upon returning, he has obtained funding as PI in the 2014 "Explora Ciencia" call from the Spanish Ministry for Economy and Competitiveness, and in 2015 he was awarded a ComFuturo grant (Fundación General CSIC competitive call for young researchers, only 14 nationwide for all areas). He is currently co-supervising two PhD thesis, and is mentoring graduate and undergraduate students working in the group. He is now leading new research lines related to the discovery of new materials with properties relevant to energy storage or chemical transformations.

Dr. Gándara has participated in 14 research projects funded by various public and private funding agencies in Spain and USA. As result, he is author of 44 research papers, all of them in high impact journals belonging to first-quartile (including 2 Science, 1 Nat. Commun, 4 Angew. Chem. Int. Ed., or 8 JACS, among others). His work has received more than 2000 citations and his current h-index is 24 (as of January 2016, Scopus source). He is also co-inventor in 5 patents (1 Spain, 4 USA), one of them licensed to BASF co.

He is an internationally recognized expert in the field of Metal-Organic Frameworks (MOFs) and related materials: he recently acted as a microsymposium chair person in the 2014 International Union of Crystallography meeting, and regularly acts as referee of various peer-reviewed journals (JACS, Chem. Eur. J, Inorg. Chem. etc). He is also member of the board of the Specialized Group of Crystallography and Crystal Growth of the Spanish Royal Society of Chemistry.

He maintains active research collaborations with several groups worldwide. His research activity is currently focused on the preparation,

AYUDAS RAMÓN Y CAJAL
CONVOCATORIA 2015

Turno de acceso general

characterization and study of properties of functional porous materials. His research covers the discovery of new MOFs and related materials, and he has developed an expertise in the structural elucidation and characterization of this kind of complex materials, and related ones. His research also covers the study of the properties of these materials for applications such as heterogeneous catalysis, gas storage, or electric conductivity.

AYUDAS RAMÓN Y CAJAL
CONVOCATORIA 2015

Turno de acceso general

Nombre: **GARCÍA FERNÁNDEZ, PEDRO DAVID**
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Título:

Disorder to enhance the light-matter interaction

Resumen de la Memoria:

By harnessing the interaction between light and matter we gained new technologies raging from incandescent light emission to LEDs. How light is emitted (and absorbed) is at the forefront of modern photonics for energy harvesting, protocols for quantum security or the generation of light-matter entanglement for quantum information technology. All these breakthroughs are based on a crucial fact: the emission (and absorption) of light depends dramatically on the environment surrounding the emitter.

My primary scientific goal is to understand how light is emitted to and propagates through structures where the dielectric function is molded at the wavelength scale. This rather fundamental research topic has strong applications in many relevant fields such as energy harvesting, imaging, lasing or quantum optics. During my research career, I explored the interplay between structural order and disorder as an alternative toolset to control the interaction between light and matter, building up my research profile upon two different pillars: material science/fabrication methods on one side and optical spectroscopy on the other.

During my Ph.D., I focused on the material science aspects of photonic structures. I made use of Fourier-transform infrared spectroscopy, ultra-fast time-of-flight and optical gating techniques to explore the role of structural imperfections in periodic, self-assembled and polymeric photonic structures. I made use of them as templates to fabricate optically active ZnO structures by exploiting atomic layer and chemical vapour deposition. In these systems, I explored the role of structural disorder in the ZnO UV lasing emission at room temperature. Following my interest on disorder, I obtained a method to fabricate completely disordered self-assembled structures composed by polymer microspheres. Their equal shape and size leads to resonant light diffusion and tuneable random lasing when optical gain is added to the structures. These results led to a patent on the emission control of random lasing. At the time of the completion of my Ph.D., I had already authored or co-authored 9 articles in journals like Physical Review Letters, Nature Photonics and Advanced Materials.

During my postdoctoral research in Denmark, I explored the role of fabrication disorder in state-of-the art semiconductor nanostructures used for quantum photonics. Disorder in photonic-crystal membranes or photonic-crystal waveguides induces very efficient confinement of light at the nanoscale, an effect also known as Anderson localization. These disorder-induced optical cavities can be used for standard cavity-quantum electrodynamic experiments to control the light-emission rate of single quantum dots competing with state-of-the art engineered cavities while being inherently robust against disorder. In addition, when the optical gain is sufficiently high as, for example, by embedding quantum wells in the structure, these random cavities provide enough optical feedback to obtain highly efficient and ultra-stable lasing. These results have been published in influential journals like Science, Nature Nanotechnology and Physical Review Letters.

Currently, I am exploring disorder in optomechanics where the mechanical vibrations of matter – phonons - are included as a new degree of freedom in the control of the light-matter interaction.

Resumen del Currículum Vitae:

I studied physics at the Complutense University of Madrid, Spain, where I obtained my master in solid state physics and fundamental physics. These studies were complemented by one full year project at the physics department of the Technical University of Munich, Germany, where I worked with Prof. Oliver Zimmer as research assistant in cold-neutron scattering. After a year working in Robert Bosch - Madrid, I received the prestigious "formación del profesorado universitario" PhD grant from the Spanish Ministry of Science and Education. I did my Ph.D. at the Materials Science Institute in Madrid under the supervision of Prof. Dr. Cefe López. I defended my PhD thesis in 2009 with the title: From photonic crystals to photonic glasses through disorder at the Autonoma University of Madrid. My PhD thesis was awarded the highest honours (summa cum laude by unanimity of the members of the panel) and it obtained the special doctorate award.

During my PhD, I joined the European Network of Excellence PHOREMOST and, within it, I spent four months in 2007 at the European Research Laboratory for Nonlinear Spectroscopy in the group of Prof. Dr. Diederik Wiersma which led to the publication of several joint articles. At the time of the completion of my PhD, I had already authored or co-authored nine articles in journals like Physical Review Letters, Nature Photonics and Advanced Materials.

After my Ph.D., I joined the Quantum Photonics group at the Technical University of Denmark led by Prof. Dr. Peter Lodahl. In 2010, I

AYUDAS RAMÓN Y CAJAL
CONVOCATORIA 2015

Turno de acceso general

obtained a three-year major research project from the Danish Natural Science Research Council as co-applicant with Prof. Dr. Lodahl. In 2012, the Quantum Photonics group moved to the Niels Bohr Institute at the University of Copenhagen where I was funded by the prestigious three-year young investigator research program from the private foundation Kann Ransmussen Villum as principal (and sole) investigator. In 2013, I was appointed Assistant Professor to developed several teaching activities in close collaboration with Prof. Dr. Kim Splittorff, the deputy head for teaching at the Niels Bohr Institute. During 2014 and 2015, I organised the focus sessions on disordered photonics at PIERS in Guangzhou and Prague, respectively.

I moved back to Spain in October 2015 to the Catalan Institute of Nanoscience and Nanotechnology (Barcelona) with the special grant "Beatriu de Pinós" from the autonomous government of Catalonia. This grant is especially dedicated to reintegrate scientists working abroad to the Spanish science system. I have just started my activity on photon-phonon coupling in complex optomechanical structures within the research group Phononic and Photonic Nanostructures led by Prof. Dr. Clivia Sotomayor Torres.

I have published 22 articles in journals such as Science, Nature Photonics, Nature Nanotechnology, Advanced Materials and Physical Review Letters with a total of 715 citations (32 citations/paper). I have an h-index 14 and I hold 2 patents (researcher ID D-3775-2014). I have been invited to the conferences Frontiers in Optics, Discussions on Nano & Mesoscopic Optics, Waves and imaging in random media, SPIE and META. I have organised a focus session on disorder photonics at PIERS conference in 2014 (Guangzhou) and 2015 (Prague). I have gained substantial experience in fundraising during my postdoctoral research in Denmark as co-applicant (765 k") and as principal investigator (460 k").

AYUDAS RAMÓN Y CAJAL
CONVOCATORIA 2015

Turno de acceso general

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Título:

Bioengineered Nanoparticles for Biosensing Applications

Resumen de la Memoria:

Dr. de la Rica&#65533;s is a young pioneer in the field of bionanotechnology. His contributions to this field have been mainly in three areas:

- Bio-enabled and bio-inspired nanofabrication of advanced materials: Dr. de la Rica demonstrated for the first time in the literature that oxide semiconductors could be grown at room temperature when using an enzyme to control the reactions conditions (Angew. Chem. 2008). He also adapted this approach for the simultaneous patterning and crystallization of oxide semiconductors with AFM nanolithography, which is a crucial step for integrating these materials with microfabricated circuits (Angew. Chem. 2010). He has also demonstrated that nanopatterns containing the enzyme glucose oxidase could be used for growing clusters of gold nanoparticles with controlled dimensions on silicon substrates. Remarkably the nanoparticles in the clusters obtained with this bio-inspired method show a high degree of crystallographic alignment (Adv. Func. Mater. 2014).

- Ultrasensitive biosensors: Dr. de la Rica has developed ultrasensitive biosensors based in two approaches: the integration of peptide nanotubes with microfabricated electrodes and the utilization of enzyme-guided nanoparticle growth as the signal generation step of immunoassays. In the first approach Dr. de la Rica modified peptide nanotubes with a biorecognition element (antibody or peptide) and placed them at the gap between two arrow-shaped electrodes by means of positive dielectrophoresis. The resulting biochips could be used for the detection of pathogens and heavy metals when the interaction between these analytes and the nanotubes changed the impedance measured between the electrodes (Angew. Chem. 2008, Small 2010). In the second approach Dr. de la Rica used concepts in nanochemistry for developing two highly innovative projects: Plasmonic ELISA and nanosensors with inverse sensitivity. In Plasmonic ELISA the enzyme label of an enzyme-linked immunosorbent assay is used to obtain solutions containing gold nanoparticles with different tonality, which allows detecting disease biomarkers at ultralow concentrations with the naked eye (Nat. Nanotechnol. 2012, Nat. Protoc. 2013). When nanosensors work with inverse sensitivity the highest signal possible is registered when the analyte is found at ultralow concentrations, which makes this approach extremely useful for ultrasensitive biosensing. This is achieved by controlling the kinetics of growth of silver nanoparticles with an enzyme in the presence of gold nanosensors (Nat. Mater. 2012).

- Nanoparticle self-assembly: Dr. de la Rica pioneered an approach in which gold nanoparticles modified with cyclodextrins were assembled with enzyme-responsive ligands. The resulting nanoparticle clusters were linked by multivalent supramolecular interactions, a phenomenon that was used to maximize the response of the assemblies to the target enzyme (as few as 23 enzyme molecules were needed to disassemble the clusters) (Angew. Chem. 2011). He also proposed the utilization of a nanopore (cucurbituril) to guide the growth of nanoparticle superstructures. In this approach the nanopore aggregates in the presence of the heavy metal precursor. The resulting nanopore aggregates recreate biological crystal growth conditions and the nanoparticles grow as superstructures assembled with subnanometric resolution (JACS 2011).

Resumen del Currículum Vitae:

Dr. Roberto de la Rica (Researcher ID F-9430-2014) was appointed as a Lecturer in Bionanotechnology at the University of Strathclyde in October 2013, where he is a group leader. Dr. de la Rica has published 33 scientific papers in journals such as Nature Materials, Nature Nanotechnology, Nature Protocols, Angewandte Chemie, Advanced Functional Materials and JACS. He is the corresponding author of 22 of those papers. To date his work has been cited 905 times. He has secured more than £160k in funding for research projects as PI from sources such as the EU, the Royal Society and the RSC, and has also received a NSF early career award (2012) and a Tom West Analytical Fellowship (2015).

Dr. de la Rica&#65533;s scientific trajectory started at the National Centre for Microelectronics in Barcelona, where he did his PhD studies. There, he was part of a multidisciplinary team aiming to develop new biosensors based on electrical transducers. During that time, he published 6 papers; 5 as first author and 4 as corresponding author, as well as one patent. These results showed his leadership capabilities even at this very early stage of his research career.

Upon graduation Dr. de la Rica immediately started working at the City University of New York as a postdoctoral research associate. It was there that he expanded his research interests into the field of bionanotechnology by drawing from his previous work experience with biosensors and lithography. While in that laboratory he guided the work of 2 PhD students and managed to publish 12 papers in 2 years in journals such as Angewandte Chemie, JACS, Advanced Functional Materials, Small and Analytical Chemistry. He is the first author of 11 of those papers and the corresponding author of 8. These outstanding results highlight his leadership potential and capability of consistently

AYUDAS RAMÓN Y CAJAL
CONVOCATORIA 2015

Turno de acceso general

delivering results and achieving impact.

After his stay in the U.S., Dr. de la Rica worked for 1 year at the University of Twente. There, he learned concepts in supramolecular chemistry and integrated them into the design of new strategies for biosensing and nanomaterials fabrication. In one year he published three papers in Angewandte Chemie, JACS and Small, all with him as first and corresponding author.

D. de la Rica was awarded a prestigious Marie Curie Fellowship that allowed him to fund his research and work independently at Imperial College London. There, he developed several approaches for the ultrasensitive detection of proteins by combining his previous background in enzyme-guided nanoparticle growth and biosensors. The outcomes of these projects were published in Nature Nanotechnology, Nature Materials and Nature Protocols with him as corresponding author. The papers had a great international impact and were commented in media around the world, from BBC news in the UK to Fox News in the US. These excellent results led to the award of a prestigious NSF early career prize in 2012. These publications and prizes have allowed Dr. de la Rica to strengthen his image as a leader in the field of bionanotechnology.

During his short stay as a group leader in Strathclyde Dr. de la Rica has been awarded a prestigious Tom West Analytic Fellowship and a research grant from Tenovus. He has also secured funds to organize an international symposium on biosensors, which has allowed him to expand his network of international collaborators.

AYUDAS RAMÓN Y CAJAL
CONVOCATORIA 2015

Turno de acceso general

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Título:

Low temperature transport studies of hybrid superconductor-semiconductor quantum dot devices

Resumen de la Memoria:

Semiconductor quantum dots (QDs) are an important system which shows great potential for applications in nanoelectronics. An important example are QD-based spin quantum bits (qubits), wherein the spin degree of freedom of an electron (or a hole) confined in a QD is used to encode quantum information. Due to their high degree o tunability, QDs can also be used to study a number of different physical phenomena. In this context, perhaps the best example is the Kondo effect, a phenomenon resulting from the scattering of conduction electrons in a metal by magnetic impurities. Indeed, QDs with odd charge occupancy behave as localized magnetic impurities which, when coupled to normal metal leads, give rise to a mesoscopic Kondo effect. As the charge state of a QD as well as its coupling to the conduction electrons of the leads can be conveniently tuned by gates, QD devices enabled the Kondo effect to be studied with unprecedented detail.

Recently, considerable interest has been drawn to hybrid superconductor-QD devices, which have been widely studied as tunable Josephson junctions, as well as a potential source of entangled electrons by the splitting of Cooper pairs. In analogy to the Kondo effect, QDs are also an ideal platform for studying Andreev levels that result from the interaction of a magnetic impurity with a superconductor. During my post-doc, I have done important contributions in this direction, including the first spin-resolved measurements of Andreev levels. Importantly, these spin-polarized states are the atomic precursors for a topological superconductor, which hosts Majorana zero modes (MZMs) at its boundaries (with applications in fault-tolerant topological quantum computation). In spite of great experimental efforts in the past years, a fully conclusive demonstration of a topological superconductor remains elusive. Recent theoretical work proposed using arrays of QDs proximity-coupled to superconductors to build a 1D topological superconductor.

This project aims to study hybrid superconductor-QD devices within two main directions. The first focuses on exploring proximity-coupled QD arrays as a platform for building a 1D topological superconductor from the bottom up. To this end, the hybridization of single dot Andreev levels into molecular levels will be studied in detail in the double QD limit. Later, longer arrays will be investigated for observing MZMs, and for probing their exotic properties. The second direction, by its turn, is devoted to the development of hybrid devices towards applications in nanoelectronics. Ultrathin superconducting contacts with high critical fields will be developed for application as a source of highly spin-polarized carriers. Hybrid devices will also be studied as a means for providing long-range coupling between spins residing in distant QDs. This holds relevance in the context of scaling spin qubits into a larger quantum computer.

In summary, hybrid superconductor-QD devices are an interesting system for studying topological superconductivity and for establishing novel applications in nanoelectronics. The long term goals of this project will pave the way for the development of a promising platform for hybrid quantum circuits, in which topological quantum information in QD arrays can be conveniently exchanged with QD-based spin qubits or superconducting qubits.

Resumen del Currículum Vitae:

- Bachelor in Materials Engineering (2002) and Master in Materials Science and Engineering (2003) at the Federal University of Sao Carlos, Brazil.
- PhD, funded by an International Max Planck Research School Fellowship, carried out at the Max Planck Institute for Solid State Research (Stuttgart, Germany) and defended at EPFL (Lausanne, Switzerland, April 2009).
- Post-doctoral work at the French Center of Atomic and Alternative Energies (CEA) partially funded by a Marie Curie Fellowship (2010-2012), and at the Institute Neel (CNRS - Institut Neel) in Grenoble, France.
-Recently awarded an Ikerbasque Research Fellowship to start quantum transport research activities at CIC-nanoGUNE (San Sebastian, Spain).
- 32 published peer-reviewed articles, including 2 Nature Nanotechnology, 1 Physical Review Letters (Editor's suggestion), 2 Advanced Materials, 2 Nano Letters and 4 Applied Physics Letters.
- Total number of citations = 1804, and H index = 20 (source: Web of Science).
- Co-supervision of students: 3 PhD students (out of which, two will defend by the end of 2016) and 4 MSc students.
- Main research interests: Nanodevices, electron (quantum) transport in low-dimensional semiconductors, including quantum dots and nanowires, induced superconductivity in low-dimensional semiconductors.
- Most relevant publications:
[1] E. J. H. Lee, X. Jiang, M. Houzet, R. Aguado, C. M. Lieber, S. De Franceschi, "Spin-resolved Andreev levels and parity crossings in hybrid superconductor-semiconductor nanostructures", NATURE NANOTECH. 9, 79 (2014). Total citations: 117

AYUDAS RAMÓN Y CAJAL
CONVOCATORIA 2015

Turno de acceso general

[2] E. J. H. Lee, X. Jiang, R. Aguado, G. Katsaros, C. M. Lieber, S. De Franceschi, "Zero-bias anomaly in a nanowire quantum dot coupled to superconductors", PHYS. REV. LETT. (Editor's suggestion) 109, 186802 (2012). Total citations: 103

[3] E. J. H. Lee, K. Balasubramanian, R. T. Weitz, M. Burghard, K. Kern, "Contact and edge effects in graphene devices", NATURE NANOTECH. 3, 486 (2008). Total citations: 325

[4] E. J. H. Lee, K. Balasubramanian, J. Dorfmueller, R. Vogelgesang, N. Fu, A. Mews, K. Kern, "Electronic band structure mapping of nanotube transistors by scanning photocurrent microscopy", SMALL 3, 2038 (2007). Total citations: 33

[5] E. J. H. Lee, C. Ribeiro, E. Longo, E. R. Leite, "Oriented attachment: an effective mechanism in the formation of anisotropic nanocrystals", J. PHYS. CHEM. B 109, 20842 (2005). Total citations: 125

AYUDAS RAMÓN Y CAJAL
CONVOCATORIA 2015

Turno de acceso general

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Título:

Innovative Carbon Nanostructures for Energy Storage

Resumen de la Memoria:

My scientific career has been linked to Materials Chemistry, Nanoscience, Nanotechnology and Energy fields being all of them strongly interconnected. 2002. Ceramic&Glass Inst. (CSIC)Undergraduate: Novel ceramic nanostructured based on zirconium oxide nanoparticles doped with dolomite for refractory and biocompatibility applications. 2003-2005. Catalysis&Petrochem. Inst. (CSIC)Graduate: Synthesis of metal nanoparticles (ruthenium, iron nanoclusters) and catalytic membranes for hydro- dehydrogenation of aromatic molecules. 2006-2009. Polymer Sci.&Tech. Inst. (CSIC), Martin-Luther Univ. (Germany), Cornell Univ. (USA), Stony Brook Univ.-BNL (USA), NanoTech -Dallas Univ. (USA)PhD: Dynamics, morphology and structure of elastomeric-composites. Solid-state NMR, X-ray, TEM, molecular dynamics by dielectric spectroscopy, In-situ synchrotron X-ray radiation during uniaxial stretching. Synthesis of Spinnable CNT forests by CVD and multifunctional CNT-polymer (Electrochemical, mechanical and electronic properties). 2009-2010. NanoTech Institute (USA)Postdoc. Researcher. (i) Mediated-nanoscale solid-state synthesis of polymer cyclic diacetylenes for the rational synthesis of carbon nanotubes. (ii) Industry: polydiacetylene nanocrystal growth-indicators. (iii) Biscrolled CNT yarns for energy applications (First µ-size CNT biscrolled Li-ion battery). (iv) Graphene and graphene nanoribbons for energy conversion and storage. 2011-2014. CIC energiGUNE (Spain)Postdoc. Researcher: Innovative electrode based on CNT¿s, high-surface area porous graphene, nanoporous activated carbon and highly oriented graphitic nanowiggles for supercapacitors. Sodium ion battery: synthesis of electroactive sodium iron phosphate and monomeric-polymeric Schiff-bases as cathode and anode respectively. Development of CNT and graphene-based cathode support for lithium and sodium-air and Li-Sulphur cell batteries. January 2015-August 2015. Warsaw University of Technology (Poland)Postdoc. Researcher: PI of the project: Synthesis of novel organic salts and polymer electrolytes for Mg-ion batteries. September 2015-Nowadays. University of Cambridge, Department of Chemistry-Research Associate: Design of innovative nanomaterials for energy applications and solid state NMR and diffraction, to investigate local structure and the role that this plays in controlling the physical properties of technologically important materials for energy applications. My previous experience has given me the skills of independence, capacity to carry out research, networking ability and leadership necessary to continue leading my own research line. The research line that I have developed is entitled: Innovative Carbon Nanostructures for Energy Storage, and the main sub-lines are the following:
[1] Preparation of novel multifunctional nanotube and graphene fibers for energy related applications. [2] Graphene nanoribbons and the study of their physico/chemical fundamental properties of assembled nanoribbons with special emphasis in the electrochemical performance for energy conversion and harvesting.[3] Highly oriented graphitic nanowiggles for energy storage. Novel carbon nanofilaments produced by CVD at relatively low temperature. [4] Nanoporous Carbon electrodes for electrochemical double-layer capacitors. [5] Porous Graphene Nanostructures for hybrid supercapacitors based on Redox-Active electrolytes.

Resumen del Currículum Vitae:

I graduated in Chemistry at the Universidad Complutense in 2002. I spent 2003 year at the Institute of Ceramic&Glass (CSIC) studying nanostructured ceramic materials for refractory and biomaterials applications (Bol.Soc.Esp.Ceram.Vidrio 2003; KeyEng.Mater 2004). I received my M. Sc. in 2005 after 2 years working in the field of nanostructured catalytic materials for hydro- dehydrogenations reactions at the Institute of Catalysis&Petroleochemistry (CSIC) (J.Memb.Sci. 2007; J.Nano.Sci.Nanotech.2007). I was awarded with FPI-MICINN grant to do my PhD in 2006 in polymer nanocomposites (structure and dynamics) with Dr. Miguel Angel López Manchado at the Institute of Polymer Science&Technology (CSIC). During my PhD I realized 3 stays: one in Prof. K. Salwaechter's group (3 months) at Martin-Luther University (Germany) working on Solid-NMR spectroscopy; another at Cornell University (USA) under supervision of Prof. E. P. Giannelis (7 months) studying the microstructure and dynamics of nanoclay-polymer hybrids systems by dielectric spectroscopy and TEM and the last one with Prof. B. S. Hsiao and Dr. S. Toki (1 month) at Stony Brook University and BNL (USA) performing In-situ Synchrotron X-Ray diffraction to polymer nanocomposites under uniaxial deformation. (Macromol. 3x 2008 and 2x2010; Soft Matter 2010 and 2011; Eur.Poly.J. 2008; I published 14 articles during my PhD). I joined the Nanotech Institute at the University of Texas at Dallas (USA) in 2008 for almost 3 years under the supervision of Prof. R. H. Baughman first as a PhD student and later as a postdoc. I designed novel multifunctional materials based on carbon nanotubes (CNT), graphene nanoribbons, and supercapacitors as well as in the rational design of CNT of unique type (Science 2011; Wold Patent 2011; Adv.Mater. 2012; Nanotech. 2012). During 2010-2014 I was a Postdoc at CIC energiGUNE (Spain) under the supervision of Prof. Teófilo Rojo and Prof. Michel Armand where I developed innovative electrode and electrolyte materials for both Batteries&Supercapacitors that can meet the need for low-cost, intermittent electrical energy storage in renewable energy sources and also for electric hybrid vehicle applications with high energy density and power capability (EU Patent EP15382163.2; EnergyEnviron.Sci. 2012 and 2015; Angew.Chem.Int. 2014; J.Mater.Chem.A 2012); Carbon 2x 2014; Electrochim.Acta 2014 and RSCAdv. 3x 2013-2014). I participated in two projects with industry and in one EU project (Graphene Flagship). I supervised 2 master students from the EU Master on EnergyConversion&Storage. Now, I am co-director of one PhD student. Then, in 2015 I moved to Poland where I was the PI of a project

AYUDAS RAMÓN Y CAJAL
CONVOCATORIA 2015

Turno de acceso general

related to the creation of novel liquid and solid electrolytes for Mg-ion batteries at Warsaw University of Technology (Poland). Since Sept. 2015, I am postdoctoral researcher at the Department of Chemistry of the University of Cambridge (UK) where I study by NMR the charge store mechanism in innovative batteries and supercaps. I demonstrated creativity and excellent capacity to carry out original research, supervising a research team and publishing high quality publications (37 articles) with more than 1500 citations. I gave 3 invited talks and more than 50 conferences. I am co-inventor of 2 patents (one under exploitation) and my H-index is 15. I have also participated in outreach activities as well as in the coordination of I+D events.

AYUDAS RAMÓN Y CAJAL
CONVOCATORIA 2015

Turno de acceso general

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Título:

Investigation Of Novel Physical Phenomena Emerging In Low-Dimensional And Nanoscale Structures.

Resumen de la Memoria:

My research experience is in the field of experimental materials science with an emphasis on the fundamental properties of nanoscale low-dimensional materials of considerable interest for potential applications. My research focuses on understanding how local interactions between atomic-scale structures affect their microscopic behavior, and how quantum mechanical effects might influence nanodevice behavior in these nanostructures. I am an expert in low temperature local-probe microscopy and spectroscopy with expertise in photoemission spectroscopy and transport spectroscopy.

During my PhD at Universidad Autónoma de Madrid (Spain), funded by two competitive grants (FPU and CAM-FPI), I carried out two pioneering instrumental developments in Spain in the field of ultra-high-vacuum low-temperature scanning probe microscopy. The first project concerned the design and construction of a UHV system equipped with a low temperature (4.2K) scanning tunneling microscope. Since 2009 I studied the fundamental properties of pristine and defective graphene at the atomic scale using this instrument, which resulted in 8 peer-reviewed publications. In the second instrumental project I contributed to transfer of the UHV and cryogenic technologies to the development of a new 4.2K non-contact atomic force microscope. I also investigated during my PhD structural phase transitions on 2D metal-semiconductor systems and on-surface molecular self-assembly. During my PhD I was invited to participate in seven research stays obtaining four of publications in topics such as 0D superconductors (Max Planck Institute (MPI)), topological insulators (Freie Univ/Aarhus Univ.) and 2D metals (Osaka Univ.).

In january 2012 I was awarded with a postdoctoral US-DOE grant to join the department of Physics at the University of California at Berkeley and the Lawrence Berkeley National Laboratory. I first conducted research towards the development of strategies for linking individual components into functioning, nanoscale artificial photosynthetic assemblies. There I also coordinated and directed the investigation of dimensionality effects in 2D transition metal dichalcogenides. I explored the electronic and optoelectronic properties of 2D TMD semiconductors as well as the behavior of superconductivity and other collective phases in 2D TMDs. During my postdoctoral stay I also studied several on-surface chemistry reactions on metals and graphene-FET devices.

In june 2015 I joined CIC nanoGUNE (Spain) through a competitive Research Ikerbasque Fellowship. My own current research is organized around three interrelated topics focused on 2D materials and layered architectures. First, I am leading a project to develop a new method to synthesize 2D materials and more complex hybrid heterostructures by combining CVD/MBE techniques. My second research line comprises the characterization and optimization of 2D material-based optoelectronic devices controlled by electrostatic gates for solar energy conversion and light emission. The third project I lead concerns the behavior of superconductivity and related collective phases in true 2D materials. The ultimate objective is to demonstrate control over these electronic ground states via external stimuli such as strain and electromagnetic fields to build links of applicability for signal processing in nanodevices.

Resumen del Currículum Vitae:

I have published 19 peer-reviewed articles in international scientific journals: Nature Materials (2), Nature Physics (1), Physical Review Letters (6), Nano Letters (2), ACS Nano (1), Physical Review B (rapid) (1) and Physical Review B (4) and Journal of Physical Chemistry C (2) with so far 782 citations in total (ISI), yielding an H-index of 11. I am first author in 7 articles (525 citations) and corresponding author in 5 of them. Two of these articles as first author currently rank in the top 10 most cited articles among the research articles published in 2010 [2014] by Physical Review Letters [Nature Materials]. I have been invited to deliver 11 oral talks, 8 in conferences and 3 in invited seminars. Overall I participated in 28 contributions to conferences and seminars, including 7 contributed talks and 10 posters. Two of my research articles have been featured as cover articles and 7 of them have been highlighted 9 times in internationally renowned journals and dozens times in scientific blogs and websites. My record of publications spans numerous relevant research topics in Materials science ranging from 2D materials to molecular chemistry at surfaces.

I am the principal investigator of three scientific projects funded by an amount of 160 K€, all of them granted since june 2015 when I reincorporated to the EU research system. These projects enabled to initiate the construction of an MBE system at CIC nanoGUNE for the synthesis of 2D materials. In total I have participated in 14 Spanish, European and U.S. research projects, one of them as coordinator at UC Berkeley. This coordination involved 7 theoretical and experimental groups from UC Berkeley, LBNL, Stanford University Monash Univ. and the Kavli Institute. This project has so far resulted since 2014 in three publications (Nat. Materials (1), Nat. Physics (1) and Nano Letters (1))

AYUDAS RAMÓN Y CAJAL
CONVOCATORIA 2015

Turno de acceso general

and other 2 works submitted. As a postdoctoral fellow I managed the research efforts of the Imaging subdivision at the JCAP hub, the US's largest research program dedicated to the development of an artificial solar-fuel generation technology. Since 2009 I also manage the research of an ongoing international collaboration among four US and European research groups. I am referee of 10 scientific journals: Nature, Nature Communications, Advanced Materials, Nano Letters, Physical Review Letters, Physical Review B, Physical Review Applied, Phys. Status Solidi, Langmuir and Fullerenes, Nanotubes and Carbon Nanostructures.

I have carried out research activity in 8 forefront research institutions in a total of 9 mid/long-term stays; some of these institutions are top-ten worldwide ranked centers. These are the University of California at Berkeley and Lawrence Berkeley National Laboratory, Max-Planck Institute, Universidad Autónoma de Madrid, Freie Universitat Berlin, Osaka University, Aarhus University and CIC nanoGUNE. I participated in 4 invited research stays during my PhD. I developed my scientific career through 4 competitive grants on a total of 6.
I have more than 200 hours of teaching experience in the physics degree (UAM). I am currently supervising one PhD student and tutoring two postdoctoral fellows at CIC nanoGUNE. I supervised one Master's research project and mentored three PhD students at UC Berkeley. I participated in the scientific committee of three national and international conferences.

AYUDAS RAMÓN Y CAJAL
CONVOCATORIA 2015

Turno de acceso general

Nombre: **LAGUNA BERCERO, MIGUEL**
Referencia: RYC-2015-19000
Área Científica: Ciencia y Tecnología de Materiales
Correo Electrónico: malaguna@unizar.es

Título:

Development of Novel Electroceramics as Components for Solid Oxide Fuel Cells and High Temperature Electrolysers

Resumen de la Memoria:

My approach during my scientific career and also for the next years is to search for novel electroceramics as components of Solid Oxide Fuel Cells. Synthesis and processing into a final device (a cell) are the challenges of this research. During my research career I have acquired experience in different fabrication methods and processing of ceramics, which is essential for the fabrication of devices using novel materials. I am able to synthesize inorganic compounds and shape them in the required geometry to fabricate the material, essential to lead this line.

Another approach to solve some of the problems of SOFC technology that I want to implement is the use of laser processing. This technique permits, for example, to control the microstructure of materials. Another laser processing related research line that I will lead is the Fabrication of Self-supported thin electrolyte membranes for electrochemical applications by Laser Machining.

According with my experience I consider of great importance to do more research in hydrogen related technologies in Spain, as it is a priority line of the Horizon2020 program in Europe, and also in USA, Korea, China and Japan. Of great interest are the high temperature electrolysis and co-electrolysis applications.

Resumen del Currículum Vitae:

My approach during my scientific career is searching for novel electroceramics as components for Solid Oxide Fuel Cells (SOFC), including the implementation of different synthesis and processing routes into a final device to be transferred to the industry. During my research career I have acquired experience in different materials science topics, with emphasis in fabrication methods and processing of ceramics, which is essential for the fabrication of devices using novel materials. My expertise also includes a deep knowledge of characterization techniques such as structural, microstructural and electrical characterization, including the design of electrochemical test stations. Finally, I also have skills for the integration of cells in small stacks and their characterization in both fuel cell and electrolysis modes.

CV summary: Master in Chemistry (2001) and PhD in Science (2005, Univ. Zaragoza). Research associate at Imperial College London from 2006 to 2009. Researcher at CSIC (ICMA) from 2009 to present. Accredited as "Ayudante doctor" (ANECA) from 2009. Teaching experience in two official Masters (Univ. Zaragoza), coordinating one course, and two invited courses at UMCE University (Santiago de Chile). Supervisor of 1 PhD (Jan. 2016), 7 final degree projects in engineering and 3 Master thesis projects, and currently supervising another PhD student (expected in Dic. 2017). Participation in 18 research projects (three of them as Principal Investigator) and 5 industrial contracts. Co-author of one licensed patent and a transfer of know-how with Saint-Gobain (70 k€), which included all the knowledge generated during my PhD. This contract launched a series of common projects with Saint-Gobain (total funding to date about 470 k€). Co-author of one book chapter edited by Wiley, 39 publications (plus other 7 under revision) in JCR journals (25 of them as a first author and/or corresponding author) and another 36 proceeding publications. 86% of them were published in first quartile journals. h index = 16. Co-author of 108 communications in national and international conferences, including 25 invited talks, 9 of them given by myself. CSIC coordinator of SP6 Hydrogen Production and Handling EERA (2014-2015). Member of the editorial board of Heliyon (Elsevier), Journal of Ceramics (Hindawi) and Frontiers in Energy Research: Fuel Cells (Nature Publishing Group). Habitual referee in 24 different journals.

AYUDAS RAMÓN Y CAJAL
CONVOCATORIA 2015

Turno de acceso general

Nombre: **PEREZ BOIX, PABLO**
Referencia: RYC-2015-17570
Área Científica: Ciencia y Tecnología de Materiales
Correo Electrónico: pablopboix@gmail.com

Título:

Optoelectronic perovskites

Resumen de la Memoria:

My research interests include developing electrochemical and optoelectronic systems, as well as unveiling their working mechanisms. During my postdoctoral experience, since 2012, I have led the perovskites optoelectronics team at NTU, generating more than 35 peer-reviewed publications (more than 58 in my career, h-index: 27) and two related patents. In this period I have proven myself in a situation where attracting research funds and collaborating with companies (Dyesol, Printed Power) is a fundamental part of the work. I have had the chance to participate in the design and composition of successful competitive proposals (more than 3, such as CRP14, Singapore) and contribute to more than 10 research projects (Co-PI in several public and industrially funded ones). This outcome also resulted in the invitation as "Young Scientist" at GYSS (Global Young Scientists Summit, 2015).

With my research on perovskite photovoltaics, practically since the initial steps of the field, I have achieved a broad vision regarding the potential of these materials for both light harvesting and light emitting applications. I truly believe that we are living a period which can be determining for the consolidation of this technology. It is necessary to carefully plan the next steps in order to stablish perovskite optoelectronics as a robust alternative; as well as to explore new applications such as transistors and lasers. My postdoctoral material science knowledge is complemented by my PhD experience, which gave me the electrochemical tools to understand the physical phenomena determining the performance of any optoelectrical device. Altogether, I believe my balanced profile is suitable to identify relevant scientific problems and lead the pathway towards their solution.

Therefore, I see this opening as a challenging opportunity to start an independent research line which aims the development of innovative optoelectronics solutions through a fundamental-science approach.

Resumen del Currículum Vitae:

My profile combines basic education in Physics (PhD by Universitat Jaume I, 2012; bachelor by Universitat de València, 2008) and Nanoscience (Master by Universitat Jaume I, 2010) with an extensive international experience developing optoelectronic devices and electrochemical characterization techniques. My research interests include developing electrochemical and optoelectronic systems and unveiling their working mechanisms. During my PhD I worked on the optoelectrical characterization and modelling of organic solar cells. In parallel, I explored the working mechanisms of silicon, dye-sensitized and quantum dot-sensitized photovoltaic devices, as well as water splitting systems. Once I joined Nanyang Technological University (Singapore, from 2012), I became a group leader in the field of perovskite optoelectronics. Metal halide perovskites are the most promising materials to form a robust photovoltaic and light-emitting technology. In this context I have had the chance to co-lead 3 research projects, apply for new funding and lead international collaborations. In total, I have participated in more than 10 international and national research projects, publishing more than 58 articles in peer-reviewed scientific journals (more than 20 of them are as corresponding or first author, with h-index: 27, from Web of Science, December 2015) and 2 provisional patents. I was able to participate as a "Young Scientist" at GYSS (Global Young Scientists Summit, January 2015, Singapore). The whole activity has been carried out in different prestigious institutions, including stays in research centres such as TUe (Netherlands), Weizmann Institute (Israel) and SKKU (South Korea) among others.

My teaching experience has focused on photoelectrochemistry and semiconductors, explaining the working principles of optoelectrical systems. These skills have been demonstrated and improved in top quality lectures (PhD courses) with excellent students' feedback, as well as in an applied training (such as summer schools) and individual mentoring of undergraduate and PhD students. I have actively coordinated the work of 4 PhD students, co-supervised 2 final year projects and 2 URECA (Undergraduate Research Experience on CAmpus) students.

This summary certifies my capability to lead an independent research line, based on a balanced combination of fundamental characterization/modelling and optoelectrical device development.

AYUDAS RAMÓN Y CAJAL
CONVOCATORIA 2015

Turno de acceso general

Nombre: **LIRAS TORRENTE, MARTA ANGELA**
Referencia: RYC-2015-18677
Área Científica: Ciencia y Tecnología de Materiales
Correo Electrónico: marta.liras@imdea.org

Título:

Design and Synthesis of Hybrid Materials for Advances Applications: Solar Fuels Generation

Resumen de la Memoria:

The Marta Liras&#65533;s curriculum vitae shows a remarkable multidisciplinary character, as well as, her scientific maturity and current independence. Each stage in her Scientific Career is supported by the previous stage, from a point of view of the skills and tools acquired in the previous phase. The main research line is the Design and Synthesis of Hybrid Materials for Advances Applications: Solar Fuels Generation. From the beginning of her scientific career her work has been focussed in the development of new polymeric system for different application. Thus, along her PhD thesis and afterwards her first postdoctoral stay she designed and synthetized new monomer based on BODIPY dyes and the polymers resulted to be used as Solid Laser Media. Her works were pioneer in this field as can be checked for the number of cites obtained in the published paper from this stage. With her internationalization stage in Canada she carried out work related with photolithography and took contact for the first time with the management and synthesis of nanoparticles such as gold, quantum dot and up conversion nanoparticles, all of them with photochemical interest. When she returned to Spain was able to use her previous knowledge and begin a new research line in her institution focused in the design of new methodologies to synthesise polymer/nanoobject hybrid that cover from metallic nanoparticles, quantum dot, upconversion nanoparticles, nanotubes and graphene. Thus, the door to different application in field so different such as photodynamic therapy, sensing and optoelectronic, has been opened depending of the nanoobject nature. Recently, she has developed new heterogeneous photocatalys based on conjugated microporous polymers that also show interesting emitting properties. Now, in the Imdea Energy Institute her work is focused into the evaluation of photocatalys based on semiconductor and conjugated polymer which goal is the solar fuels production.
Her scientist career along these years allowed her to work with different research groups in different I+D research centres, to acquired knowledge in different research areas, to develop and optimize new methodologies and to characterize several photophysical and photochemical properties. During her last stage she has demonstrated the independence in her research lines as well as an improvement in the published papers attending to the high impact factor and the number of authors. Her experience assures the adequate development of project in the Ramon y Cajal Programme and allows her to advance in the knowledge of synthesis-properties-applications relationship of new photosensitive hybrid materials and their potential applications.

Resumen del Currículum Vitae:

Marta Liras&#65533;s curriculum vita shows a remarkable multidisciplinary character, as well as, her scientific maturity and current independence. Each stage in her Scientific Career is supported by the previous stage, from a point of view of the skills and tools acquired in the previous phase. She obtained her PhD in 2003 at Chemistry Science by UCM under the supervision Prof. Amat Guerri and Prof. Sastre from IQOG-CSIC and from ICTP-CSIC, respectively. The same year she coursed the &#65533;Master degree in Plastics and Rubber&#65533; by the ICTP - CSIC. During 2004 she enjoyed a postdoctoral fellowship, funded by Comunidad Autónoma de Madrid. She was awarded with a postdoctoral grand into the Juan de la Cierva Programme (2005-2007) and with a JAE-Doc contract funded by European Social Fund (2009-2012). She was a postdoctoral fellow at the University of Ottawa (Canada) under the supervision of J. C. Scaiano (2008, 2009). Today she works as researcher in the IMDEA-Energy Institute. Dr. Marta Liras has 52 science papers published (plus 3 more submitted or in preparation), 12 as corresponding author. Besides, she has published an Invention Patent. These publications sum currently a total of 800 cites in the JRC (by SCOPUS) journals (with an average citation per item of 17.31 and h-index of 18). For their impact index and high quality it is important to mention: 1 Adv. Funct. Mater. (10.179), 1 (Chem Mater, 8.535), 2 Nanoscale (7.394), 3 J. Mater. Chem. (6.108), 2 Org. Lett. (5.862), 4 Macromolecules, (5.8), 2 Polymer Sci (5.231), and 5 PCCP (4.493). She is also a regular scientific referee of RSC, ACS, Elsevier and Wiley. A total of 36 communications to National (10) and International (25) Congresses has been presented, 20 as Oral Communications, and 2 of them as Invited Lectures. She has supervised to several student both graduate and master and currently she is codirecting a PhD. She has participated in 17 competitive projects both national and international including Consolider and ERC-consolidator as well as project with important companies such as Intel. Moreover, she was reserve in the Ramon y Cajal Call 2013.

AYUDAS RAMÓN Y CAJAL
CONVOCATORIA 2015

Turno de acceso general

Nombre: **ABARGUES LÓPEZ, RAFAEL**
Referencia: RYC-2015-18349
Área Científica: Ciencia y Tecnología de Materiales
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Título:

Síntesis de Nanocomposites multifuncionales basados en materiales nanoestructurados y polímeros para aplicaciones industriales

Resumen de la Memoria:

1- Master in Chemistry 1994-2000 (Universidad de Valencia)

Dr. Rafael Abargues López started his master in Chemistry studies in 1994 at the Universidad de Valencia, receiving his university degree in 2000. During his last degree year he got a collaboration fellowship to carry out his final master thesis in the Organic Chemistry chair of the Faculty of Chemistry of the University of Valencia. The research consisted in the fluorination of organic compounds with antifungal properties. Because of the positive results, the candidate obtained the maximum qualification.

2- Ph.D. in Chemistry 2001-2006 (University of Erlangen-Nuremberg, Germany)

In 2001 he moved to Germany and joined Infineon Technologies AG as a PhD student (2000-2006) under the supervision of Prof. Dr. Ulrich Nickel (Physical-Chemistry Chair, University of Erlangen-Nuremberg) and Dr. Klaus Elian (Leader Group at Infineon Technologies AG).

The aim of the thesis was to investigate new materials to eliminate charging in electron beam lithography by means of organic conducting polymers. Two strategies were developed. The first approach was to synthesize a conducting bottom layer placed underneath an imaging e-beam resist. Conductivity equal or greater than 10-4 S/cm has been reported to prevent pattern displacement in such a resist system. The way to achieve all these properties consisted in synthesizing a conducting polymer inside an insulating polymer, this is, an interpenetrating polymer networks (IPN).

Novolak and PMMA were used as insulating host polymers since they possess most of the properties that are expected of a bottom layer except for conductivity. Several monomers could be polymerized inside the Novolak and PMMA matrix with different oxidants. Novolak and PMMA-based IPN films of the order of 10-5 S/cm to 150 S/cm were thus prepared by a one-step in situ polymerization during the bake step. Further focus was set in terthiophene, Cu(ClO4)2 as monomer and oxidant salt respectively and Novolak or PMMA as host polymers.

The second approach was to carry out a feasibility study of the synthesis and development of a conducting positive-tone imaging resist. The level of conductivity necessary has not been determined yet. The first strategy involved the use of main chain scission-type polymers. Conducting IPN based on PMMA showed imaging properties upon e-beam exposure. Line/space patterns of 150 nm could be resolved but with very high dose of radiation. This too low sensitivity was attributed to the significant degree of networking of the resulting conducting IPN. Another way of approaching the conducting patternable resist was to synthesized polymers with both chemically amplified imaging and conducting properties.

3-Post-doc and Senior Researcher 2006-2010 (Universidad de Valencia)

In June 2006, he joined the Unit of Materials and Devices for Optoelectronics led by Prof. Juan P. Martinez-Pastor at the Materials Science Institute of the University of Valencia as a postdoctoral fellow. Before joining UMDO, the main activity and excellence of the research group was the optical properties of semiconductor quantum nanostructures. The candidate was incorporated to launch and consolidate a new research line in the synthesis of nanomaterials.

During that time, he started researching in the synthesis of two different types of nanoparticles:
1. Noble Metal Nanopartic

Resumen del Currículum Vitae:

The candidate has a MSc in chemistry (University of Valencia) and a PhD in Chemistry (University of Erlangen-Nuremberg (Germany)) for his thesis on electrically conducting polymer synthesis for electron beam lithography carried out at Infineon Technologies AG. He then joined the UMDO group at the University of Valencia as a postdoctoral fellow where he launched a new research line in the field of the synthesis of novel nanomaterials for optoelectronics, photovoltaics and sensing. At the end of 2009, he co-founded Intenanomat S.L., a spin-off company of the University of Valencia where he is currently the R&D manager. Intenanomat is aimed at the research and development of nanomaterials for high-performance device applications in biotechnology, sensing, optoelectronics, catalysis and renewable energy.

AYUDAS RAMÓN Y CAJAL
CONVOCATORIA 2015

Turno de acceso general

The main research line of the candidate is focused on nanocomposite as new multifunctional nanomaterials for optoelectronics, energy generation, sensing and catalysis. In particular he has a great interest in the synthesis of nanocomposite based on inorganic nanoparticles (metal nanoparticles and quantum dots) embedded in polymers or metal-oxide matrices. Nanocomposite combine the singular properties of nanoparticles (e.g., tunable photoluminescence, localized surface plasmon resonance, superparamagnetism,) with unique properties of polymers and metal oxides (mechanical properties, thin film processing, conductive/dielectric properties, low cost, photocalytic properties). Due to the combination of these properties, nanocomposite are ideal candidates for the low-cost fabrication of the next generation of high-performance micro and nanodevices in solid-state.

Currently, the candidate has published more than 60 peer review papers, 9 patents, more than 50 conference contributions, and has received more than 450 citations, a H=13 and a i10=17in the area of Nanoscience/Nanotechnology and Physical-Chemistry (Source: Google Scholar). He is currently supervising 2 Ph.D. theses and has supervised 4 master theses

AYUDAS RAMÓN Y CAJAL
CONVOCATORIA 2015

Turno de acceso general

Nombre: **INFANTES MOLINA, ANTONIA**
Referencia: RYC-2015-17870
Área Científica: Ciencia y Tecnología de Materiales
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Título:

Nanomaterials, clean energy and environmental pollution

Resumen de la Memoria:

My research has been devoted to the development of nanostructured materials for environmental catalysis and clean energy production. During my predoctoral period, at the University of Malaga (UMA) (2002-2006), several methodological approaches were investigated in order to tune the textural and structural properties of catalysts based on metals supported on mesoporous materials, and a large spectrum of characterization techniques was used, including FTIR studies of adsorbed probe molecules at the University of Genova. The postdoctoral period started with a 2-years contract (Excellence Project) at the UMA, where a new synthetic procedure to prepare catalysts based on transition metal phosphides to be used for heteroatoms removal for oil upgrading was carried out. This new synthetic approach opened up new an international collaboration with the Research group of Prof. Oyama at Virginia Tech University (EEUU). In this period, I also collaborated with the group of Prof. Cavalcante, Universidade Federal do Ceará (Brasil), to study S-containing molecules removal by adsorbent materials. In 2009, I obtained a Juan de la Cierva Fellowship (JCI-2009-05821) for joining the Structure and Reactivity Group (Prof. García Fierro) in the Institute of Catalysis and Petroleochemistry (Madrid). The research line was the preparation of nanocatalysts to produce clean fuels from fossil (oil) and renewable (biomass) sources. I have also carried out several research stays in the Laboratory of Catalysis and Catalytic Processes at Politecnico di Milano (Center of Excellence), firstly as a Visiting Researcher to study NOx catalytic removal from mobile sources, in collaboration with ENEL and Pirelli Eco Technology, and later as Associate Researcher to study CO2 reutilization to produce fuels and chemicals in collaboration with Marie Tecnimont Enterprise and ENEA (Ministero dello Sviluppo Economico-Italy). In the last 2 years I have opened new international collaboration with the University of Venice, University of Perugia, University of Aveiro, University Autonomous of Mexico and University of La Habana. I have participated in 2 proposals (1 national and 1 international) to move forward in new and promising research lines related to novel materials for clean energy production from renewable sources, waste water treatment and absorbent materials for environmental pollutants.

Resumen del Currículum Vitae:

I studied Chemical Engineering at the University of Málaga (2002), starting mi research way during my last year at the University (Collaboration grant with Departments). In November 2002, I got a research contract inside an European Project (GRD2-2000-30316) and in September 2003 I started the PhD (Pre-doctoral fellowship (UAC2003-0036)) to finish my PhD Thesis on July 6th, 2006-European Mention. My Thesis work was focused on the preparation of supported catalysts for diesel upgrading with a stay at the University of Genova. In 2007, I started my postdoctoral research period with a postdoctoral excellence contract from Junta of Andalusia devoted to nanoporous solids for environmental catalysis. This project lead to the development of a novel synthetic route to prepare highly active nanocatalysts with important publications in international journals. In this period I also joined the group of Pesquisa em Separações por Adsorção, Universidade Federal do Ceará (Brasil) to study adsorbent materials. In 2009 I obtained a Juan de la Cierva Fellowship (JCI-2009-05821) and on April 2010 I joined the Institute of Catalysis and Petroleochemistry (ICP-CSIC) in Madrid, the research line being the preparation of catalytic systems for the production of clean fuels. During the last years I have also joined the Laboratory of Catalysis and Catalytic Processes group at Politecnico di Milano to start new catalytic research lines related to NOx catalytic removal from mobile sources (Pirelli Co and ENEL enterprises) first as a visitant researcher; and to study catalytic processes for CO2 transformation later as an associate researcher (ENEA and Marie Tecnimont Enterprise). I have obtained 3 grants from the government (2 predoctoral and 1 postdoctoral) and 6 research contracts (1 predoctoral and 5 postdoctoral). I have been member of three research groups (2 nationals and 1 international), I have done several international stays and I have participated in several national and international I+D+i Projects (13). I have published 2 chapter books and more than 50 articles in peer-reviewed international journals: 31 as first or second author, and 12 as corresponding author, resulting in an h index of 16 and a high number of citations (more than 650 citations). I have also presented 67 communications at national and international recognized conferences. To mention is the contribution at the 247TH ACS Meeting& Exposition. Chemistry and Materials for Energy-Energy and Fuels division (March 2014), as an invited speaker. I have been co-advisor of 2 PhD Thesis (European Mention) and currently supervising other two ones; 8 Final Projects of students from Chemical Engineering, 4 works leading to an ASD at the UMA and 4 Minor Thesis at the Politecnico of Milan . I have been reviewer of manuscripts from several JCR journals and Editor of 2 International journals. In these years I have opened collaborations with 10 international research groups and several national groups. In 2010, I was founding member of the Spin-off enterprise VACOQUING at PTA-Málaga. Moreover, I also collaborate with the enterprise EPCOS. I have been member of the organizing committee of 3 international congresses and member of the Sociedad Española

AYUDAS RAMÓN Y CAJAL
CONVOCATORIA 2015

Turno de acceso general

de Catálisis. From October 2015 I am in charge of a NMR spectrometer of solids, I am receiving specific formation (training courses) and I have stayed two weeks in the ITQ-UPV (Valencia-Spain) to learn about NMR.

AYUDAS RAMÓN Y CAJAL
CONVOCATORIA 2015

Turno de acceso general

Nombre: **BONELL , FRÉDÉRIC**
Referencia: RYC-2015-18523
Área Científica: Ciencia y Tecnología de Materiales
Correo Electrónico: frederic.bonell@icn.cat

Título:

Spintronics with topological insulators

Resumen de la Memoria:

My research topics deal with spintronics, surface and interface science, with a strong expertise in sample fabrication, advanced characterization techniques and magnetotransport. For the past 10 years, my interest focuses on the magnetism of thin films grown by molecular beam epitaxy and on spin-related phenomena. I had so far the opportunity to develop multi-disciplinary experimental skills, which span the growth of multilayers, the measurement of their structural, chemical and electronic properties, their patterning into nanodevices, and finally, the study of spin-polarized transport. My research also involves the use of synchrotron radiation, through XMCD and photoemission experiments.

The main research lines I developed in French (2006-2009), Japanese (2010-2013) and Spanish (2014-) institutions under competitive funding (JSPS grant in Japan, Marie Curie grant in Spain) are the following:

- spin-polarized tunneling in epitaxial magnetic tunnel junctions: influence of structural quality and electronic structure on transport, optimization of the tunnel magnetoresistance;
- electric field control of perpendicular magnetic anisotropy: exploration of new magnetic materials showing a large electric field effect, voltage driven spin dynamics, XMCD studies of the microscopic mechanisms;
- spintronics with graphene and topological insulators: optimization of Bi2Se3 and Bi2Te3 epitaxy, dc/rf study of spin transport in nanodevices.

I co-authored 32 publications, with a total number of 491 citations (Web of Science) / 733 citations (Scholar) and an h-index of 14 (Web of Science). Several achievements were published in high impact journals (Physical Review Letters and Nature Publishing Group's journals) and were rewarded by 14 invitations to international conferences.

My research contributes currently to the growing fields of graphene spintronics and spin-orbitronics, through the investigation of spin relaxation in graphene, current-induced spin-orbit torques and the study of the Edelstein effect at the surface of topological insulators.

Resumen del Currículum Vitae:

I received a diploma in physics engineering along with a Master degree in nanoscience from the Institut National des Sciences Appliquées (Toulouse, France) in 2006. My doctoral work was done from 2006 to 2009 in the Institut Jean Lamour (Nancy, France) under the supervision of Prof. S. Andrieu. My PhD thesis was presented in Nov. 2009 to a jury presided by Prof. A. Fert, 2007 Nobel Prize in physics, and received the "Best Thesis in Physics" award from the universities of Lorraine. In 2010, I started a first postdoctoral stay in Osaka University (group of Prof. Y. Suzuki) under a competitive funding from the Japanese Society for the Promotion of Science (JSPS). This project was followed by an extension of my contract for 18 months. In 2014, I have been awarded an FP7 IEF Marie Curie grant to join the team of Prof. S. Valenzuela in the Institut Català de Nanociència I Nanotecnologia (ICN2) in Barcelona where I am developing my research on graphene spintronics and spin-orbitronics.

My research has focuses on several sub-fields of spintronics, in particular on spin tunnelling, electric field control of anisotropy, graphene spintronics and spin-orbit torques from topological insulators. My experimental expertise combines:
- material/device fabrication (MBE, photo- and electron beam lithography)
- lab-based characterizations (XRD, RHEED, XPS, Auger, ARPES, STM)
- synchrotron-based advanced characterizations (XMCD, spin-resolved ARPES)
- dc and rf magnetotransport

I contributed actively to several national and international projects (French ANR, France-Spain Hubert Curien Partnership, Japanese CREST, FP6 Network of Excellence and FP7 ERC Starting Grant). I also participated to collaborations with groups in France (SPINTEC and ESRF, Grenoble; GEMAC, Versailles; CEMES, Toulouse; SOLEIL, Orsay), Spain (Universidad Autónoma de Madrid, ICN2), Germany (KIT), Japan (AIST, Spring-8), Corea (Inha University), Belgium (INPAC, Leuven) and Switzerland (EPF Zurich). Most of these collaborations resulted in publications.

AYUDAS RAMÓN Y CAJAL
CONVOCATORIA 2015

Turno de acceso general

I co-authored 32 publications, with a total number of 491 citations (Web of Science) / 733 citations (Scholar) and an h-index of 14. Several achievements were published in high impact journals (Physical Review Letters and Nature Publishing Group's journals) and were rewarded by 14 invitations to international conferences.

I demonstrated leading capacities by triggering new research lines for my host institutions, secured funding for my research and wrote 10 successful proposals for synchrotron experiments.

I received a complete training in teaching (French "Monitorat"), taught during 3 years at French "Grandes Ecoles", been accredited by the National Council of Universities (qualification "Maître de Conférences" from CNU) and co-supervised the work of 3 Master/Doctor students.

AYUDAS RAMÓN Y CAJAL
CONVOCATORIA 2015

Turno de acceso general

Nombre: **MAS MORUNO, CARLOS**
Referencia: RYC-2015-18566
Área Científica: Ciencia y Tecnología de Materiales
Correo Electrónico: carles.mas.moruno@gmail.com

Título:

NOVEL CHEMICAL COATINGS IN SURFACE SCIENCE: TOWARDS MULTIFUNCTIONAL BIOMATERIALS FOR REGENERATIVE MEDICINE

Resumen de la Memoria:

The research line proposed here focuses on the biofunctionalization of implant materials to develop novel multifunctional biomaterials and medical devices for application in tissue healing and regenerative medicine. In particular, these biomaterials are intended to stimulate and guide cell behavior and be used for bone regeneration in dental and orthopedic applications. To this end, Dr. Mas explores the design of a series of innovative biofunctional coatings based on linear, cyclic and multivalent peptides, peptidomimetics, and nanopolymers with a diverse range of biological activities including cell adhesive properties, osteogenic potential and antibacterial features.

The bioengineering of implant materials with tissue regenerative properties constitutes a constantly expanding field that is likely to introduce revolutionary changes in classical healthcare and drastically improve the quality of life of patients. This research line requires a highly multidisciplinary approach, combining high quality and scientific excellence in the fields of Chemistry, Biochemistry and Materials Science to address a major challenge in Medicine.

Dr. Mas is currently researcher at the group of Biomaterials, Biomechanics and Tissue Engineering of the Technical University of Catalonia (UPC) (2011-present). PhD in Chemistry at the Institute for Research in Biomedicine of the University of Barcelona (2009) and visiting scholar at Harvard Medical School, Boston, USA (2007). Postdoctoral researcher at the Technical University of Munich (TUM), Germany (2009-2011) and Project Team Leader at the International Graduate School of Science and Engineering of the TUM (2009-2011). Awarded with a Marie Curie Career Integration Grant (2012-2015).

During his scientific career he has explored the use of peptides and peptidomimetics for biomedical applications, including anti-endotoxin agents for the treatment of sepsis, integrin-antagonists for anti-cancer therapies and more recently coating molecules to develop biomaterials for tissue regeneration. Dr Mas has pioneered the development of peptidic ligands with integrin subtype selectivity and their application for surface coating. Dr. Mas has made many significant contributions to this scientific field, in which he has initiated and leads a series of novel research lines. His recent research focuses on the concept of multifunctionality, an innovative approach that overcomes most limitations of classical strategies in biomaterials surface coating.

His research potential and capacity to go further beyond the state of the art have been proven by his excellent scientific record and experience, which have been repeatedly awarded and recognized at the national and international level.

Dr. Mas has established his own research lines and is currently leading a subgroup of research within the group of Biomaterials, Biomechanics and Tissue Engineering of the UPC. Thus, the aim of the candidate applying for this Ramón y Cajal grant is to consolidate and strengthen his position as independent researcher, and fully establish himself within the Spanish academic and/or research system.

Resumen del Currículum Vitae:

CURRENT POSITION: Researcher at the group of Biomaterials, Biomechanics and Tissue Engineering of the Technical University of Catalonia (UPC) (Since 2011).

PREVIOUS EXPERIENCE: PhD in Chemistry at the Institute for Research in Biomedicine of the University of Barcelona (2009) and visiting scholar at Harvard Medical School, Boston, USA (2007). Postdoctoral researcher at the Technical University of Munich (TUM), Germany (2009-2011) and Project Team Leader at the International Graduate School of Science and Engineering of the TUM (2009-2011). Marie Curie CIG fellow (2012-2015).

SCIENTIFIC PRODUCTION: Author of 27 papers in peer-reviewed journals, 3 reviews and 2 book chapters, including Angew. Chem. Int. Ed. [5], J. Med. Chem. [3], Chem.-Eur. J. [2], ACS Appl. Mater. Interfaces [2], Acta Biomater. [1], Adv. Healthcare Mater. [1], Biomacromolecules [1], Colloids Surf. B-Biointerfaces [2], Bioconjugate Chem. [1] and J. Org. Chem. [1] (average IF for these publications: 7.3). 79% of the publications in journals of the Q1; 97% in the Q1+Q2. >460 citations (Scopus) (>600 by Google Scholar), H-index: 11 (14 by Google Scholar). Last and/or corresponding author in 5 articles (45% of publications of the last 2 years). 22 publications without the PhD supervisor (>73% of total).

AYUDAS RAMÓN Y CAJAL
CONVOCATORIA 2015

Turno de acceso general

CONFERENCES: >45 contributions to international conferences, 3 invited keynote lectures and 8 awards. Organizer and coordinator of the course "New Strategies in the Design of Biomaterials: Surface Functionalization with Peptides and Proteins" (2012, UPC). Member of the organizing and/or scientific committee of the international 26th Bioceramics conference (2014), the COST TD1208 2nd Annual Meeting (2015), and the XXXVIII national conference on Biomaterials and Biomechanics (2015).

PROJECTS: Participation in >10 competitive national and European projects as team member, coordinator or head researcher. PI of the European project "Development of new biofunctionalized materials for application in regenerative medicine" (BIOMAT4BIOMED, FP7-PEOPLE-2012-CIG), associate partner of the European project "Stem cell recruiting by novel CXCR4 ligands" (BioMat03-CXCR4, IGSSE-TUM). Coordinator of the grant proposal "Biofunctionalized porous titanium scaffolds to replace intervertebral disks" (SMARTiPORE, H2020, PHC-16-2015) (not funded). Preparation of an ERC grant as PI (ERC-2016-STG, CosMoS) (under evaluation).

DIRECTION OF STUDENTS: Director of 2 PhD Thesis (UPC), 2 exchange PhD students from the TUM (Germany), 1 Master Thesis and 6 national/European End of Course Projects (UPC).

TEACHING: University teaching in Chemistry (2009, UB) and since 2011 in Industrial Engineering, Masters in Biomedical Engineering and Materials Science, and in the AMASE European Master (UPC).

AWARDS: Best PhD Thesis of the University of Barcelona in 2009 (XV Premi 2011 Claustre de Doctors, UB) Young Investigator Awards (2008 Helsinki, 2010 Copenhagen, 2010 Kyoto, 2011 San Diego, 2015 Glasgow). Director of works awarded by the SIBB (2014 Madrid, 2015 Barcelona). Recipient of a Marie Curie Career Integration Grant (2012-2015). Awarded with 94.4/100 points (position 16/165) in the previous Ramón y Cajal call (RYC-2014-16145) (#1 in the reserve list). Not funded.

OTHER MERITS: Reviewer for leading journals and of project proposals for the Czech Science Foundation. Accreditations of tenure-track lecturer (2012) and tenured assistant professor (2014) by the Catalan University Quality Assu

AYUDAS RAMÓN Y CAJAL
CONVOCATORIA 2015

Turno de acceso general

Nombre: **PAZOS PEREZ, NICOLAS**
Referencia: RYC-2015-19107
Área Científica: Ciencia y Tecnología de Materiales
Correo Electrónico: npazosperez@gmail.com

Título:

Development of new plasmonic platforms for SERS detection

Resumen de la Memoria:

With a Chemistry BCs (2004) and a materials science PhD (Nov 2008), Nicolas Pazos Perez possesses a highly multidisciplinary profile. Overall, the research throughout his career has been mainly devoted to the investigation of plasmonic materials, from synthesis, functionalization, characterization and applications. Initially, during his PhD studies co-supervised by Prof. Liz Marzan in Spain and Prof. Giersig in Germany, he focused on the synthesis of plasmonic materials and their surface functionalization. His Pioneer PhD work was focused on controlling size and shape of plasmonic and magnetic particles either in aqueous or organic solvents and their phase transfer reactions through surface modification. In consequence, he was able to grow epitaxialy plasmonic materials on the surface of preformed magnetic particles controlling independently the size and shape of each constituent. Therefore, being able to separately a la carte tuning the magnetic and optical properties of these materials. Subsequently, he continued with the development of plasmonic structures and started to use them for the development of sensors using surface enhanced Raman scattering (SERS) spectroscopy as a postdoctoral research associated at the group of Prof. Liz Marzan. Then, in August 2009, He joined the physical chemistry II department at the university of Bayreuth in Germany in the group of Prof. Fery where he started to work on particle alignment and functionalization of substrates using micro-contact printing and AFM as characterization tool. After several months working on this topic, he set up a new research line within the group by joining all the previously acquired knowledge. The development of organized plasmonic substrates for SERS detection, and the control over plasmonic coupling became a core topic of his group in Bayreuth composed of a PhD student and several master students that he mentored and supervised. During these 5 years as group leader in Bayreuth he develop techniques for organizing plasmonic structures on substrates like supercrystals, linear arrays, or 3D superstructures studying their plasmonic responses and their usability as SERS platforms. Moreover, he was also able to organize particles in solution forming clusters with concrete number of particles (dimmers, trimmers, tetramers). Nowadays, after he was granted with an IEF Marie-Curie grant, and returned back to Spain he works at the University Rovira I Virgili in Tarragona at the group of Prof. Alvarez Puebla as group leader in charge of the synthesis of highly efficient plasmonic structures for SERS sensing. With a group of 3 PhD students, his main research line is the development of possible commercial able sensor devices for health care, using bio-functionalized SERS encoded nanoparticles either in fluids or in organized substrates.

Resumen del Currículum Vitae:

Dr. Nicolas Pazos-Perez received his PhD degree in Physical Chemistry in 2008 from the University of Vigo (UVigo, Spain).). His PhD studies were conducted between Spain and Germany at the Colloidal Chemistry Group (CCG) supervised by Prof. Luis Liz Marzan and co-advised at the Center of Advanced Studies and Research (Caesar) in Bonn (Germany) by Prof. Michael Giersig. He has a Chemistry BSc from UVigo (Vigo, Spain 2004) where he also worked as a postdoc in 2009 at the CCG. After this period, he joined the Department of Physical Chemistry II at the University of Bayreuth (Germany) as a Postdoctoral Research associate. Almost 5 years later, in 2013 he moves back to Spain (Tarragona), and become a Senior Researcher officer at Medcom Advance. Currently (since 2014) he works as senior Postdoctoral Research associate in the Zeptonic group (Department of Physical Chemistry) at the University Rovira i Virgili (Tarragona, Spain) as a Marie Curie Fellow.

Whit more than 30 papers in prestigious journals being one of the principal investigators in the 70 % of his publications either as a corresponding (8) or as first author (13), has an h-index of 18 with more than 850 citations. Due to the quality of his work, 3 patents that were written in order to protect the intellectual property and their possible commercialization

Besides his relatively short scientific carrier, Dr. Pazos-Perez has earn the recognition from his fellow researchers for the quality and relevance of his work. Some evidences of this recognition are depicted from his scientific contributions which have been highlighted articles and hot papers ranked between the most read and most cited articles, including also several cover pages (7). He is also an active referee of many prestigious peer review journals and has given many oral presentations at international conferences including invited and plenary lectures being also awarded with two poster prices.

He is also involve in the formation of young scientist by directing and mentoring masters students (7 defended) and doctoral thesis (4 in total, 1 finish and 3 in progress). Demonstrating his management and leadership skills as group leader by planning experiments, problem solving, decision making, and communication abilities together with the ability to get funding as for example, an Intra-European fellowship (IEF-Marie Curie) and a TECNIOspring fellowship co-financed by the Marie Curie actions and the COFUND regional program with a total funding of 355.956 from 2014 till 2016.

His work involve several research areas like the wet chemical synthesis of plasmonic nanoparticles, including their shape and size control, functionalization, coating, and their self-assembly into ordered structures at the nano and macro scales, with the aim of controlling their individual and collective plasmonic response together with the development of highly efficient SERS encoded nanoparticles and substrates. Currently, his scientific interests is focused in the synthesis and bio-functionalization of SERS encoded plasmonic nanomaterials,

AYUDAS RAMÓN Y CAJAL
CONVOCATORIA 2015

Turno de acceso general

envisioning their use as SERS based detection systems for biomedical applications.