



AYUDAS RAMÓN Y CAJAL CONVOCATORIA 2019

Turno de acceso general

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Título:

Smart functionalization of nanomaterials for biomedical applications

Resumen de la Memoria:

Over the past years my research has mainly focused on the smart functionalization of nanomaterials for biomedical applications. I have worked extensively on the synthesis and functionalization of gold and magnetic nanoparticles with different biomolecules to create highly active NP-biomolecules that can be used to develop innovative applications, including: novel i) targeting strategies, ii) controlled drug release methodologies based on hyperthermia, iii) biosensing strategies. I have a strong multidisciplinary background that covers all the aspects ranging from the synthesis and characterization of nanoparticles, to the evaluation of their interactions with cell cultures, invertebrate and vertebrate models.

During my PhD (Institute of Nanoscience of Aragon) I focused on the synthesis of magnetic nanoparticles and their functionalization with a wide variety of biologically relevant biomolecules (in an oriented manner) for their use in therapy and/or diagnosis. The grand aim was to understand how the grafting molecules and their density could affect the biological fate of the nanoparticles. I was also devoted to create highly active magnetic nanoparticles-antibody conjugates for the development of more sensitive biosensors.

I was then hired as a postdoctoral researcher within a ERC Starting project (Institute of Nanoscience of Aragon) to develop an innovative and versatile methodology for controlled drug release by means of magnetic hyperthermia. I continued to study the relationship between the molecule attached to the nanoparticles surface and the biological response of the nanoparticles, this time setting up the facilities to work with vertebrate animals.

In September 2015 I was awarded with a Marie Curie Individual Fellowship and moved to Naples (Italy) to start a project that involved the use of an invertebrate model organism to screen the effects of gold nanoparticles after laser irradiation. The grand aim of the project was to understand cellular responses to heat stress after photothermal therapy, improving its efficacy for clinical purposes. This project offered me the possibility to acquire an outstanding training on molecular biology techniques and on invertebrate animal handling. This model is ideal for toxicological and regenerative purposes and also provides worthy data before reaching vertebrate animals, without posing ethical issues.

Since January 2018 I am a Juan de la Cierva Incorporación Fellow at the Aragón Materials Science Institute (ICMA-CSIC). I am developing my own research line focused on the activation of intracellular signalings by using truncated proteins to immobilize magnetic nanoparticles in a cellular membrane. I have been recently awarded a ERC Starting Grant, an ambitious project aiming to selectively control intracellular pathways related to mechanotransduction and tissue regeneration. This project merges my previous background in Materials Science, Molecular Biology, Bioconjugate Chemistry and cellular models. Further, I am participating in different projects based on the development of new ultrasensitive biosensors based of highly active NPs-biomolecules.

Resumen del Currículum Vitae:

I started my research career at the National Center of Biotechnology (Madrid) as a postgraduate grant-assisted student. I then obtained the Advanced Studies Diploma (DEA) in Molecular Biology in 2006 (University of Navarra). I did my PhD at the Institute of Nanoscience of Aragon (Zaragoza), in the frame of a prestigious national project entitled Nanotechnology in biomedicine (Consolider Ingenio-2006-2010). During this period I worked on the synthesis and multi-functionalization of magnetic nanoparticles, obtaining the PhD extraordinary award (Chemistry) from the University of Zaragoza.

After completing my PhD (September 2012), I returned to work at the Institute of Nanoscience of Aragon, hired as a postdoctoral researcher for the NANOPUZZLE ERC Starting Grant project. This period permitted me to co-direct 2 PhD students, whose projects were published in *Angewandte Chemie* (inside cover) and *ACS Applied Materials and Interfaces*. The strategies of functionalization that we developed during this period were transferred to a company.

In September 2015 I was awarded with a prestigious Marie Curie Individual Fellowship and moved to Naples (Italy) and in 2018 with a Juan



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de la Cierva Incorporacion Fellowship (Aragón Materials Science Institute-CSIC).

I have published 44 original research articles and reviews (93% in Q1, 57% in D1) in high impact international journals, including 3 ACS Nano (IF=13.3), 1 Advanced Drug Delivery Reviews (IF=15.5), 2 Angewandte Chemie (IF=11.7), 3 ACS Applied Materials and Interfaces (IF=8.45), among others (28% of them have impact factors above 7). I am corresponding author of 4 of the publications, having participated also in 5 invited book chapters. The quality of these publications has been recognized by several key citations (1229 citations; H-index=20-Scopus), an average of 190 cites per year in the last 5 years, and a Normalized Impact Factor (according to the Spanish Ministry of Science) for the 2014-2018 period of 1.79.

I have given 14 oral communications (5 invited), have been invited to lecture in 6 recognized courses or Research Institutes and to teach a one-week Master course at the University of Uruguay. Currently I lecture in the Biomedical Engineering Master offered by the University of Zaragoza and regularly participate in dissemination events for the general public. I am review editor of one indexed journal, have been external evaluator of 1 PhD thesis and of international R&D projects.

In the last years I have secured funding for my research raising >2M , including a ERC Starting Grant (1.78M), a regional Project (60k) and a Marie Curie Fellowship (180k). Further, I have participated in 6 European projects (including a ERC Starting Grant, a ERC Proof of Concept and two ERA-NETs), in 8 competitive research projects funded by national and regional agencies and in 1 project funded by a company. My leadership qualities and independent thinking are also demonstrated by the co-direction of 2 PhD, 4 MSc and 2 BSc students to completion. Currently I am directing 3 PhD students.



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Título:

Fine-tuned carbon nanostructures for environmental catalysis and advanced membrane technologies: from nano- to macro-scale

Resumen de la Memoria:

I am an international expert in Material Science, Nanotechnology, Catalysis and Separation Processes. Throughout my career, I developed innovative materials with tailored physicochemical properties (nano-scale) and tuned shapes (macro-scale) to be applied in environmental catalysis and membrane technology. My contributions to these fields are chronologically listed below:

2005/2009 Predoctoral step

During my PhD Thesis-FPU Grant at U. of Granada (UGR), I prepare noble metal-catalysts supported on a wide set of advanced carbon materials (e.g., aerogels, nanofibers, etc.) for the gas-phase combustion of VOCs. At that time, I actively collaborate with F. Kapteijn from TuDelft (Netherlands) and F. Ribeiro from U. of Lisbon (Portugal) with the aim of developing structured catalysts on cordierite monoliths and foams. I also did an internship (7 months) at Laboratory LSRE-LCM of U. of Porto (UP, Portugal), where I worked in the removal of recalcitrant water pollutants by advanced oxidation technologies (AOTs). The excellence of my PhD allowed to achieve important scientific contributions in the field of catalytic oxidation, leading to a patent, 10 JCR-articles and the Doctorate Award 2009 for the best PhD Thesis.

2010/2017 Postdoctoral step

My long-term interest on water remediation motivate me to select LSRE-LCM at UP as my main Postdoctoral Centre for 7 years, although other internships (6 months) were carried out in NCSR Demokritos Athens (Greece) and U. of Cincinnati (USA), under the framework of EU projects. The knowledge acquired in Materials Science and Reaction Engineering serve me of great assistance for synthesizing semiconductors and membranes based on graphene, carbon nanotubes and nanodiamonds to be applied for the removal of microcontaminants by photocatalysis, which were new topics at LSRE-LCM. These pioneering works resulted in hot articles and invited lectures in the AOT field. In 2016, I become Associate Researcher at LSRE-LCM under the very competitive FCT Investigator Programme, similar to Ramon y Cajal call in Spain. I also acquire leadership as IP of a 5-year Exploratory Project funded by FCT (Portugal), which enables me for the recruitment of young scholars to work in a research line concerning carbon-based membranes for fresh water production from seawater and wastewater. This project continues to be explored under my supervision.

2018/Today Consolidation step

Since Nov-2017, I am Associate Researcher at UGR after being awarded with a project dealing with catalysts and membranes based on graphene for: (i) water purification by desalination and AOTs, (ii) generation of solar fuels by CO₂ photo-reduction, and (iii) value-added products by hydrogenation from biomass. Furthermore, I am also co-IP of a National Project funded by MCIU, participate as Team member in an EU Project (PRIMA), a CYTED network and 2 Portuguese Projects with UP and U. of Aveiro funded by Europe2020, and finally, I closely collaborate with Adventech® Company (Portugal) for the research in wastewater treatment and reuse. Overall, I have raised funds of 350K as IP and 10M as Team member in multiple projects, as well as I composed my own network of international partners from university and industry, which proves my multidisciplinary profile, independency, recruitment ability and guaranties the success application in future calls and works.

Resumen del Currículum Vitae:

I am graduated in Chemistry by U. of Jaen (2003) and received my PhD degree (Doctorate Award and EU Mention) at U. of Granada (UGR) in 2009 through a FPU Grant. Part of my thesis was conducted at Laboratory LSRE-LCM of U. of Porto (UP, Portugal) under the guidance of Prof. JL Figueiredo (h-index=65), a recognized expert in advanced carbon materials. In Nov-2010, I moved again to UP as Postdoctoral researcher: firstly, hired in the FP7 EU Project Clean Water (GA nº 22017 FP7), then with a 5-year Grant (SFRH/BPD/74239/2010) funded by FCT, and in Nov-2016 as Associate Researcher after being selected in the competitive FCT Investigator Programme. After 7-year postdoc stay, I returned to Spain under the call Projects for the Incorporation of Young Researchers, where I was hired as IP of a project funded by UGR about graphene-based materials for environmental applications. Currently, I am also IP of 2 more projects: one funded by MCIU (ref. RTI2018-099224-B-I00) and other in Portugal funded by FCT (IF/00573/2015). I have participated as team member in 18 projects approved in very competitive calls, highlighting 3 European Projects (PRIMA, COST Action ES1403 and FP7), 1 CYTED Ibero-American Network (Triton-P315RT0027), 9 in Portugal (FCT, QREN, NORTE) and 5 in Spain. At that time, I have established collaborations with groups in Portugal, Belgium, Netherlands, Slovenia, Italy, USA and Greece, where I carried out several internships.

Concerning to my scientific productivity, I co-authored 60 publications (plus 5 submitted), including 45 international peer reviewed ISI indexed journals (h-index=23 and >1500 citations, Scopus 13/01/19); 5 no-ISI articles and 10 chapters in books with peer review from Editorials like Elsevier, Wiley, etc. Most of papers (80%) were published in TOP25% Journals and 14 as corresponding author, highlighting 11 Applied Catalysis B Environmental (IF = 14.229, #1TOP journal in the category of: Engineering, Environmental, Source WOS), 2 CEJ, 1 Water Res, 1 J Hazard Mater, 2 Carbon, 1 J Mem Sci (IF of these papers > 7). Four of the papers were selected as featured journal covers. I



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am also co-inventor of an international patent, co-editor of 6 special issues of international scientific journals and co-author of over 100 communications in conference proceedings, including 4 invited lectures, 43 oral presentations and 2 awards for the best communication. I have acted as member of 6 Examination Boards of doctoral thesis, as evaluator of research projects in international calls and referee of 30 top-ranked journals (Mater Today, Appl Catal B, Carbon, J Mem Sci, CEJ, etc). I collaborated in the organization of 8 national/international conferences (CICAT, GEC, RIA, ELGQ), the 2nd European PhD School in AOPs and at least, other 10 events for science dissemination to the society.

Regarding to my teaching expertise, I have lectured over 900 hours in 6 different higher education courses at both UGR and UP, been invited as Professor of specialized seminars at FEUP, UGR and International University of Andalusia, and collaborated in Teaching Innovation Activities such as, 2 Projects, 3 publications and 2 meeting communications. To date, I have supervised many temporary visiting students, 2 post-doc, 8 MSc and 1 PhD students and currently, 3 MSc and 2 PhD are on-going. I was selected as reserve in the Ramon y Cajal Calls 2016 and 2017.



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Título:

Magnetic Molecules for Quantum Information and Spintronics

Resumen de la Memoria:

My research activity during my PhD at the University of Zaragoza was centered on the study of magnetic nanomaterials with special focus on single-molecule magnets (SMM). My experimental research dealt with two different aspects: quantum properties of SMM and the role played by dipolar interactions in their crystals. During my PhD, I installed the dilution refrigerator required for the measurements that is now key in the research of my former group. Thanks to this, pure dipolar magnetic order could be experimentally induced by quantum annealing in several crystals of SMM. Other quantum phenomena in SMM unveiled during this period are: (a) the first quantum phase transition observed in a mesoscopic crystal of molecules. In this state the quantum entanglement between spins is maximum and could be exploited for quantum information. (b) The oscillation of the macroscopic dynamics of SMM induced by quantum interferences. The understanding of these quantum phenomena fills a gap in fundamental physics and is the base to use SMM as future components of quantum computation. Other magnetic systems studied were spin glasses and SMM hybridized with 2D layered materials. Here I proved the coexistence of magnetism with superconductivity in the same material.

Seeking to explore the single molecule level, I moved for a postdoc position at Delft University of Technology (Holland) where I combined my expertise in SMM with molecular spintronics devices. An individual molecule is linked between two nanometer-spaced electrodes that are used to apply an electrical current. A third gate electrode completes this single-molecule-based transistor. I optimized the devices made by nanofabrication and designed and performed the measurements and analysis. I demonstrated that the complex magnetic properties of individual magnetic molecules can be preserved when they link to electrodes. Moreover, they can be modified by adding a single electron in a controlled and reversible way. In this direction, I proposed and demonstrated that the current through individual magnetic molecules can be controlled through their vibrations. This opened new research venues in my group centered in vibronics.

There, I was awarded with a Dutch VENI fellowship (250 k €) and a FET European project (1 M €) as PI. The shared scientific goal was to explore organic radicals and organic graphene electrodes. The team I led at Delft developed these electrodes and demonstrated room temperature stability of such devices and successfully linked different molecules. This is a requisite for future industrial applications. Focusing on organic radicals, together with my team, I demonstrated Kondo physics, signature of a localized spin in the molecule even in the absence of metals. I proved electrical control on the magnetic ground state that can lead to molecule-based quantum gates.

In 2017 I moved to IMDEA Nano in Spain to work in merging magnetic molecules with magnetic low-dimensional materials for their use in quantum computing. I already proved that the band gap structure of carbon nanotubes can be modified with encapsulated organic molecules and proved magnetism in a natural 2D material. I obtained a Marie Curie fellowship (170 k €), an Atracción del Talento de la Comunidad de Madrid (240k €) and a Plan Nacional (121k €) as PI that promoted me to Senior Researcher with my own independent lab and students.

Resumen del Currículum Vitae:

I obtained my PhD from the University of Zaragoza working in the field of molecule-based nanomaterials. During this time I was awarded by the CSIC with an I3P-JAE fellowship and I realized two short international internships at Leiden University (2006) and University of Modena (2008). My thesis work (2011) was awarded with the highest honor Cum Laude. The research carried out during this period involved the study of quantum properties and dipolar interactions in single-molecule magnets crystals and other magnetic materials. Most of my thesis results are published in high-impact journals: Phys Rev Lett, Adv Mater, Phys Rev B, Chem A-Eur J among others. I am very committed with the dissemination to the general public. During this period I was involved in popular science activities as part of 2 competitive R&D innovative teaching projects.

I moved for a postdoc position at Delft University of Technology (2011-2016) where I extended my work on magnetic molecules to the individual molecule level and the applications in molecular electronics and spintronics. My results are published in high-impact journals such as: Nature Phys, Phys Rev Lett, Nano Lett, and ACS Nano mostly as first or corresponding author. The relevance of my work granted me invitations to a book chapter, invited talks and seminars in top international research centers. In this period I started my teaching activity in the Molecular Electronics course. In addition to my teaching duties, I supervised several students (3 PhD daily supervisor, 2 bachelor, 2 exchange student).

Aiming to consolidate my research career, I actively and successfully applied for European funding. My project: molecular spintronics and graphene was awarded with the prestigious Dutch fellowship VENI that aims to consolidate the career of young scientists. This personal grant provides with 250 k € for three years. As VENI fellow, I contributed to build an interdisciplinary consortium with three other European



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groups, and as a PI, I successfully obtained a highly competitive FET-OPEN European grant from the European Commission. This grant aimed to young researchers provides with 1 M for the consortium for three years. The combination of these projects strengthened my scientific independence and allowed me to form a small research group by hiring a post-doc. I was invited to a seminar in the Research Valorization Centre (Delft 2014) that recognizes my positive experience in writing proposals.

In January 2017 I moved to IMDEA Nano (Spain) to continue my work on molecular spintronics and 2D materials for quantum computing. For this, I obtained as PI a Marie-Curie individual fellowship (170k), Atracción del Talento fellowship (240 k) and a Plan Nacional (121 k) that promoted me to senior researcher with my own lab(<https://bit.ly/2uN1nv9>), students and publications in Chem Sci, 2D Mater, Angew Chem.

I have participated in 15 R&D&I competitive projects: 7 European, 1 Dutch, 7 Spanish, including 2 teaching innovation projects. I have written and led 6 as PI that sum over 1 M . My scientific record includes 36 publications: 12 as first author, 17 as corresponding author in high-impact journals: 1 Nature Phys, 1 Angewandte, 1 JACS, 4 Phys Rev Lett (one Editor s suggestion), 3 Nano Lett, 2 ACS Nano and 1 Adv Mater. I have participated in more than 20 prestigious conferences including invited contributions.



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Título:

Topological materials and collective properties of colloidal particles

Resumen de la Memoria:

I am a theoretical physicist working on a wide range of applied and fundamental aspects of Material Science and Complex Systems in Soft Matter.

During my doctoral studies and the first two years of postdoctoral experience (Universidad Autónoma de Madrid, Spain 2004-2010) I developed density functional theories for lyotropic liquid crystals. I studied theoretically the bulk properties of several model liquid crystals, and the confinement of liquid crystals.

In the period 2010-2011 I moved to the University of Lisbon (Portugal) as a postdoctoral fellow. I developed a theory to study the bulk phase behaviour and the percolation properties of mixtures of patchy colloids. Patchy colloids (colloidal particles with interaction sites on the surface) constitute the focus of very active research due to their technological applications in Material Science. I predicted new types of percolated gels that were later found experimentally.

Since 2012 I work, with research independence, at the University of Bayreuth (Germany) where I have obtained the Habilitation (2017). I work on several interconnected research lines covering fundamental and applied aspects of Material Science. On the applied side I use, e.g., computer simulations to study the formation of topological defects on confined liquid crystals, nonequilibrium phase behaviour in active systems, and the bulk phase behaviour of several models of colloidal particles. On the more fundamental side I have developed e.g. a complete theory of sedimentation for binary mixtures, a theory to obtain canonical information from grand canonical density functional theories, and a new simulation method to sample the density distribution of particles in a many-body system using computer simulations. The method improves both the accuracy and the performance with respect to the traditional counting of particles. I am currently developing variational theories for the dynamics of many-body systems (overdamped and inertial) using power functional approaches. In close collaboration with experimentalists I am developing new materials for the topologically protected motion of colloidal particles using magnetic patterns.

Resumen del Currículum Vitae:

I finished my PhD studies on density functional theory for lyotropic liquid crystals at the Universidad Autónoma de Madrid (Spain) in 2008 under the supervision of Prof. Enrique Velasco funded by a competitive FPU grant. I started my postdoctoral studies at the Universidad Autónoma de Madrid with both a project-based contract (50%) and a temporary civil servant position Profesor Titular Interino (50%). I moved afterwards (2010) to work on self-assembled materials made of patchy colloids as a postdoctoral fellow under the competitive program Estancias de Movilidad Posdoctoral en Centros Extranjeros in the group of Prof. Margarida M. Telo da Gama in Lisbon (Portugal). Since 2012 I have been working, with research independence, at the University of Bayreuth (Germany) in the group of Prof. Matthias Schmidt.

In 2017 I completed the Habilitation (highest qualification level that serves as the qualification for a university professorship in Germany). I am currently a Senior Researcher (Akademischer Oberrat Privatdozent temporary civil servant) with both research and teaching duties. I accumulate almost 10 years of postdoctoral experience in international institutions.

I have published 50 publications (+1 accepted +1 under review) in peer-reviewed international journals (47 of them in the first quartile Q1). Among others I have published in the highly selective journals of Nature Communications (1), Physical Review Letters (7, one of them Editors Suggestions), and Communication Physics (1 published + 1 accepted). I am the first and/or corresponding author in 36 out of my 50 publications. My publications have received over 800 citations, with an h-index of 19 (Google Scholar) and an average of 110 citation/year during the last 5 years. Some of my works have been highlighted either on the journal cover (Soft Matter) or selected by the editors as "Hot Publications" in Soft Matter and "Editors' suggestions" in Phys. Rev. Lett. I was invited (2017) to contribute to the special issue "Emerging Leaders" in the Journal of Physics: Condensed Matter which recognizes the "talents of exceptional, upcoming researchers".

I have made 43 contributions to several conferences and workshops, including 8 invited talks and 13 contributed talks. I have been invited to give 10 seminars in different Universities.



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I have participated as a researcher in 10 competitive research projects: 7 funded by Spanish research agencies (MINECO and Comunidad de Madrid), 2 funded by the FCT (Portugal), and 1 funded by the European Union (FP7). I was recently the PI of a competitive project of the DAAD (Germany 10 kEUR). I am currently the PI of a competitive DFG project (Germany - approx. 400 kEUR).

I have co-supervised 9 Bachelor students, 3 Master students, and 1 PhD student. I am currently supervising one PhD student and one Master student. The results of five Bachelor theses and those of the Master and PhD theses have been published in prestigious journals.

I have ample experience teaching (>30 semesters) at both graduate and undergraduate levels. In 2014 the students awarded me with the The Golden Chalk Award for the best instructor.

I collaborate with several research groups. Despite the fundamental character of my research I collaborate with four experimental groups (8 joint publications so far).



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Título:

Noncrystals for advanced suprastructures

Resumen de la Memoria:

Currently I am a senior researcher at the Functional nanomaterials group (The Catalonia Institute for Energy Research, IREC, Barcelona) and an associate professor at the Material Science and Engineering department (Universitat Politècnica de Catalunya, Barcelona). As a material scientist and nanotechnologist, my research is focused in the development of novel suprastructures made of nanocrystals for nanomedicine, water remediation or electrocatalysis.

During my PhD (Excellent Cum Laude, Fundamental Physics department, UB, 2009), I developed novel colloidal synthesis approaches for the production of high quality magnetic nanoparticles. We were able to develop nanoparticles with outstanding magnetic properties for nanomedicine. After spending one year at the Functional Nanomaterials group (Electronic department UB) I joined the Nanochemistry department at the Istituto Italiano di Tecnologia (2010). There I worked under the framework of the MAGNYFICO-FP7 project developing magnetic nanoparticles for magnetic hyperthermia. At IIT, I developed novel approaches for the synthesis of water soluble iron oxide nanocubes and set the magnetic characterization laboratory for the characterization of magnetic colloids. Later as a senior postdoc (2012), I developed novel procedures for the production of nanoheterostructures such as gold-iron oxide or gold-cadmium sulfide dimers for catalysis and nanomedicine (NANOARCH-ERC). I got the chance to coordinate an international small team advising junior researchers (PhD and Master students). In 2013 I got awarded with a QualityNano Transnational Access action (ICN-TAF-166) and visited Prof. V. Puntès laboratory at the Catalan Institute of Nanoscience and Nanotechnology (ICN2, 2013).

Back in Spain and after a short stay at IREC (FP7-UNION project 2014), I got awarded with a TecnioSpring MarieCurie fellow (TECSPR14-1-0053) and joined the Zeptonic group (Dr. P. Rivera-Gil) at the Center for Chemical Technology (CTQC, Taragona). In the framework of this project, I joined the group of Prof. D. Brougham (Dublin City University, DCU, 2015) as a visiting researcher. At DCU and CTQC, I exploited nanocrystals for the formation of hierarchical 3D structures and co-coordinated one Explora project (SAF2015-73052-EXP). At DCU I set a colloidal synthesis laboratory and an hyperthermia characterization device while contributing in the formation and mentoring of PhD students and one senior researcher. November 2016, I moved to the Bioelectronics & Biosensors group at ICN2 as a Severo-Ochoa fellow where I kept developing nanomaterials for advance structures. In particular, I developed graphene-based nanocomposite micromotors for sensing applications. In September 2017, I was awarded with a second TecnioSpringPlus MarieCurie project (TECSPR16-1-0082) and joined IREC as a TecnioSpring researcher and IIT as an associate researcher. Along these two years, I developed novel hierarchical suprastructures (clusters and aerogels) for biomedicine and environmental applications in collaboration of a PhD student.

Since 2019, I stabilized my research line at IREC setting a laboratory with all the devices required for the formation of porous materials. Currently, I am PI for one national project (Geltherm RTI2018-102006-J-I00) and responsible for IREC of two work packages for a FetOPEN project (UncorrelaTEd 863222).

Resumen del Currículum Vitae:

My main research activities at IREC deal with the development of hierarchical superstructures combining nanocrystals into 3D porous aerogel structures for energy, biomedical, catalysis or environmental applications. At IREC I am currently developing my own research line as part of the Functional nanomaterials group (Prof. A. Cabot) co-supervising a PhD student (Mr. Xang Wang). I also co-supervise a student from the Amirkabir University of Technology (Iran) together with Dr. H. Shahverdi. I am also coordinating the research activities of the national project Geltherm (RTI2018-102006-J-I00) as PI, and I am responsible for two work packages of the FET-OPEN EU project UncorrelaTEd (863222). As a researcher, I directly participated in more than 7 EU projects and more than 6 National projects. I co-coordinated two MarieCurie actions (TECSPR14-1-0053 and TECSPR16-1-0082) a QualityNano TA (ICN-TAF-166) and an Explora project (SAF2015-73052-EXP).

My research has been initially focused in the colloidal synthesis of nanocrystals; first for applications in nanomedicine being extended to catalysis and energy harvesting. Nevertheless, my current activities are focused in the exploitation of nanostructures (nanocrystals or nanoheterostructures) as building blocks for novel hierarchical nanostructured suprastructures (clusters or aerogels). During my career, I have actively participated in multidisciplinary projects starting several research lines in different laboratories. Initially, and as a PhD student at the Magnetic Nanomaterials group (University of Barcelona, Prof. X. Batlle), where I set the colloidal synthesis laboratory, and developed the research line about synthesis of magnetic nanoparticles for biomedical applications. After a short period at the group of Prof. Andreu Cabot (UB, 2009), I joined IIT and worked on several projects (FP7-MAGNYFICO and NANO-ARCH ERC) under the supervision of Prof. Liberato Manna and Dr. Teresa Pellegrino. At IIT, I set a new research line for the synthesis of magnetic nanoparticles for hyperthermia applications, developed the hyperthermia characterization laboratory and participated in the installation of the magnetic



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characterization laboratory (2010-2013). Back in Spain (2014), and after a short stay at IREC under the supervision of Prof. Andreu Cabot (FP7-UNION project), I was awarded with a Tecniospring-MarieCurie fellowship (TECSPR14-1-0053). There I started a new research line for the synthesis of magnetic nanoparticles and its hierarchical assembly into supercrystals. During this period, I visited Dr. D. Brougham's group (DCU, Ireland, 2014-2015) and later on worked as a Severo Ochoa fellow at the Nanobioelectronics & Biosensors Group (ICN2-2016-2017). At ICN2 my research was devoted self-propelled nano- and microrobots for sensing applications (environmental and biomedical). At the end of 2017 I was awarded with a Tecniospring-MarieCurie fellowship (TECSPR14-1-0053) and joined IREC and IIT. The above describe activities result in more than 45 papers published in international journal (>2700, h-25), 4 patents, more than 15 oral contribution to international and national conferences (7 invited), and the co-supervision of two PhD students. During the last two years, I combined my research activities with mentoring activities as an assistant professor at the Universtiat Politecnica de Catalunya



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Título:

Corrosion Mechanisms of Magnesium Alloys and Anomalous Hydrogen Evolution for the Fabrication of Advanced Lightweight Materials

Resumen de la Memoria:

Dr. Santiago Fajardo, graduated in Chemistry from the Universidad Autónoma de Madrid in 2007, received his PhD (cum laude and European Doctorate Mention) from the Universidad Complutense de Madrid in 2012. In 2008 he was awarded a JAE-Pre fellowship for the completion of his doctoral thesis at the National Centre for Metallurgical Research (CENIM-CSIC) on the corrosion resistance of austenitic stainless steels under the supervision of Prof. J.M. Bastidas. During his PhD work, Dr. Fajardo was a visiting scholar (6 months funded by the Predoctoral CSIC Fellowships for foreign stays Program) at the Imperial College London under the supervision of Prof. M.P. Ryan.

In 2014, Dr. Fajardo was offered a Postdoctoral Researcher position at the Fontana Corrosion Center (The Ohio State University, USA) by Prof. G.S. Frankel. While at OSU, Dr. Fajardo consolidated a new research line on dissolving Mg surfaces, developing a very sensitive gravimetric approach for measuring hydrogen evolution rates. The candidate also led a contract funded by the Air Force Research Lab on the mechanisms of corrosion Al-Li alloys. He also mentored a large group of graduate students (>5) and established international collaborations with researchers from Swansea University and Monash University, among others.

In 2016, Dr. Fajardo was awarded both the Juan de la Cierva Incorporación fellowship and the National Project MAT2015-74420-JIN, funded with 195.000 €. He opted for the latter and since 2017 Dr. Fajardo is a senior postdoctoral researcher at CENIM-CSIC, where he is the Principal Investigator (PI) of the Project Study on the Corrosion Mechanisms of Magnesium and Anodic Hydrogen Evolution for the Fabrication of Advanced Magnesium Alloys which will be due at the end of 2019.

The quality indicators of the scientific research of the candidate can be summarized as follows:

77 scientific contributions: 43 scientific articles (33 included in JCR, 85% Q1, 54% 1st or last Author), 5 book chapters, 8 scientific-technical reports and 21 conference papers.

h-index/i10-index/m-index = 20/24/1.7 (Google Scholar), 17/24/1.4 (Scopus).

Total citations/cites-per-year within postdoctoral period: 1249/165 (Google Scholar) and 965/127 (Scopus). Citations/cites-per-year (5 last years): 1082/216 (Google Scholar) and 843/169 (Scopus).

Participation in 13 R&D projects, 2 of them as PI, raising funds over 200.000 €.

International participation in a European Union Project (2008) and a project with Air Force Research Laboratory USA (2015).

70% publications during postdoctoral period with international coauthors (75% as corresponding author demonstrating his international leadership).

Supervised 4 final-degree projects (TFG) and 1 MSc degree thesis (TFM). Mentored 2 postdoctoral researchers (2018-2019; CENIM-CSIC) and > 5 undergraduate/MSc/PhD students (Research Group of Prof. G.S. Frankel, FCC-OSU).

Dr. Fajardo has advanced the state-of-the-art for the understanding of the anomalous evolution of H₂ on anodically polarized Mg via a rigorous experimental programme underpinned by the theoretical understanding of the electrochemical principles of aqueous corrosion. His studies include major contributions to the field and contain important and novel scientific contributions to several experimental observations.

Resumen del Currículum Vitae:

Dr. Santiago Fajardo, graduated in Chemistry from the Universidad Autónoma de Madrid in 2007, received his PhD (cum laude and European Doctorate Mention) from the Universidad Complutense de Madrid in 2012. In 2008 he was awarded a JAE-Pre fellowship for the completion of his doctoral thesis at the National Centre for Metallurgical Research (CENIM-CSIC) on the corrosion resistance of austenitic stainless steels under the supervision of Prof. J.M. Bastidas. During his PhD work, Dr. Fajardo was a visiting scholar (6 months funded by the Predoctoral CSIC Fellowships for foreign stays Program) at the Imperial College London.

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In 2016, Dr. Fajardo was awarded both the Juan de la Cierva Incorporación fellowship and the National Project MAT2015-74420-JIN, funded with 195.000 €. He opted for the latter and since 2017 Dr. Fajardo is a senior postdoctoral researcher at CENIM-CSIC, where he is the Principal Investigator (PI) of the Project Study on the Corrosion Mechanisms of Magnesium and Anodic Hydrogen Evolution for the Fabrication of Advanced Magnesium Alloys, which finished at the end of 2019.

Dr. Fajardo has been involved with several projects throughout his career. His primary interest is in advanced light alloys and, more



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specifically, he leads a research line on the dissolution mechanisms of Mg alloys and the anomalous behavior of hydrogen evolution (HE) on dissolving Mg surfaces. This is a hot topic in corrosion these days, aiming to improve the durability of these materials for strategic applications such as the aerospace, green transportation and energy industries. The work that carried out by the candidate has become a major contribution to the field. Also, he developed a very sensitive gravimetric approach for measuring HE rate and used it to show that the anomalously high HE rate is connected with the increased catalytic activity of the local regions of high dissolution.

The candidate is an active member of the International Society of Electrochemistry, The Electrochemical Society and the Committee of Communication, Education and Scientific Culture in the CENIM-CSIC. He is also a member of the AEI review panel. Dr. Fajardo has participated as member of 3 doctoral thesis PhD committees (1 international in Monash University). He is a member of the Editorial Board of Frontiers in Materials (JCR IF 2018: 2.689, Q2) and Electrochem journals. Dr. Fajardo, is the organizer of the Seminars on Corrosion Science in the CENIM-CSIC. The candidate has been invited to participate in 4 international seminars, workshops and/or courses.

Dr. Fajardo collaborates actively The Ohio State University (USA), Monash University (Australia), Swansea University (UK) and Chalmers University (Sweden). During his postdoctoral stage he has been an invited scholar at Swansea University (2016) and Monash University (2017-2018).



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Turno de acceso general

Nombre: CARRILLO CARRION, CAROLINA
Referencia: RYC2019-027527-I
Área Temática: Ciencias y tecnologías de materiales
Correo Electrónico: carolcc83@hotmail.com

Título:

Hybrid functional nanomaterials for (bio)applications

Resumen de la Memoria:

Dr. Carrillo-Carrion has developed her scientific career at the interface of material science, (bio)nanotechnology, and (bio)analytical chemistry. Her research covers a wide spectrum of topics, including the design and synthesis of customized functional nanomaterials, studies for getting a better understanding of their properties and behavior, and their final exploitation in bioapplications. This multidisciplinary profile is the result of her involvement in research groups from different disciplines.

She obtained her PhD at the University of Córdoba in 2011 under the supervision of Prof. M. Valcárcel, receiving the doctorate extraordinary award. Her research topic was preparing functionalized quantum dots for developing novel analytical methodologies. She performed a research stay at the Vienna University of Technology (Austria) working on plasmonic hybrid nanostructures to exploit surface-enhanced raman spectroscopy technique. Next, she moved to a biotech company (Biomedal, Seville) as responsible of the analytical department and R&D projects. Her management of industrial and industrial-academia projects (in collaboration with the University of Seville) and her active research work led to several commercial products for celiac disease and also provided scientific productivity. She returned to academia by joining the Philipps-Universität Marburg (Germany) as Humboldt postdoctoral fellow (2013-2015) under the guidance of Prof. W.J. Parak, for designing customized functional nanomaterials with application in the bioanalytical field. From 2015 to 2017 she worked at biomaGUNE (San Sebastián) as a Juan de la Cierva-Incorporación postdoctoral fellow (ranked #3, material science category, score: 99.10 of 100). With the aim of expanding her areas of expertise, she worked on new research lines dealing with the fate and integrity of nanoparticles inside cells, studies of the protein corona around nanoparticles, and fluorinated nanoparticles for use in fluorine magnetic resonance imaging. Next, she was awarded with the Marie Skłodowska-Curie Individual Fellowship (score: 95.60%) to develop external-stimuli responsive nanoplatfoms based on metal-organic frameworks. During this 2-year project (01/2018-12/2019), hosted by the CIQUS―University of Santiago de Compostela, she set up a new research line (metal-organic framework for bioapplications) in the bionanotools group. This new research line has allowed the incorporation of 3 PhD students, and also starting collaborations with highly recognized researchers (Dr. P. Horcajada, and Prof. J.L. Mascareñas). In January 2020 she is joining the FMQ-383 NANOVAL group at UCO, lead by Prof. Rafael Luque.

Her mid-to-long term scientific interests are oriented towards a more applied research, particularly the development of nanotools with a potential socio-economic impact from an industrial perspective. In this direction she has applied for a JIN project within the 2019 Call of the Spanish Retos Investigación, which is focused on producing multi-catalytic compartmentalized nanocomposites able to perform non-orthogonal tandem reactions for application in the fine chemical and pharmaceutical industry. Currently, joined to NANOVAL group, she is working on a proposal (H2020-FNR-11-2020), involving partners from 7 countries, for chemo-enzymatic/nano-strategies to liberate bioactive compounds from biomass.

Resumen del Currículum Vitae:

The scientific career of Dr. Carrillo-Carrion has been focused on Materials Science, (Bio)Nanotechnology, and (Bio)Analytical Chemistry. She has expertise on the design, synthesis, and characterization of novel functional hybrid nanomaterials, and their following exploitation in bioapplications (mainly sensing, bioimaging, drug delivery, and catalysis). This multidisciplinary research training has been possible thanks to different spanish, german and european fellowships, obtained all of them in competitive calls (FPU, Alexander von Humboldt, Juan de la Cierva-Incorporación, and recently Marie Skłodowska-Curie Individual Fellowship), as well as her involvement in research groups from different disciplines throughout the different stages in her career.

To date, she is author of 57 SCI publications (92 % of articles in Q1) plus 2 submitted, has an h-index of 24 and 1546 citations (WoS, 01/01/2020). The relevance of the performed research is highlighted by the number of publications in high impact journals (Nat. Commun., Angew. Chem., ACS Nano, Chem. Mater., Appl. Mat. Today, Nanoscale, Small, Chem. Commun., etc), and it must be highlighted the increase of research productivity of the candidate in the last years. The candidate appears as corresponding author in 9 publications, which is a clear indication of the beginning of her independency as researcher. She has also 34 contributions (15 oral communications and 2 invited talks) to national and international conferences, and has participated in 13 competitive research projects and 1 industry-academia project. In 4 of those projects she was the principal investigator (PI). Additionally, the candidate has already participated as a member of a PhD thesis tribunal (March 2016), which can be also seen as a proof of having reached the required scientific maturity for starting her independent career. She has experience in official teaching, and recently got the ANECA accreditation for Profesor Contratado Doctor. She



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acts as reviewer for several scientific journals, and last year served as guest editor of MDPI Biosensors journal.

She has proved her leadership abilities being in charge of several projects, taking responsibility for the Bioengineered Particles laboratory at CIC biomaGUNE for 2 years on behalf of Prof. W.J. Parak (who had its main affiliation in Germany), and supervising several Master and PhD students, as well as students during traineeship in company. Moreover, her position in a company as the responsible of the analytical and R&D departments endorses her leadership character and management skills. During the last 2-year Marie Curie project, the candidate reinforced her management skills, supervising and teaching skills, as well as her ability to set up a new research line and establishing new research collaborations.

In the last two calls she applied for Ramon y Cajal fellowship, being ranked with 93,50 (position 25, reserve status) in RYC-2018 and with 90,00 (position 28, reserve status) in RYC-2017.



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Nombre: SIERRA GARCIA, JUAN FRANCISCO
Referencia: RYC2019-028368-I
Área Temática: Ciencias y tecnologías de materiales
Correo Electrónico: juanfrancisco.sierra@gmail.com

Título:

Two-dimensional materials for advanced electronic devices

Resumen de la Memoria:

Juan F Sierra is an experimentalist in the areas of condensed matter physics, materials science and device fabrication. Since starting the PhD (Universidad Autónoma de Madrid UAM), he has conducted his research in top national and international research centers including the Condensed Matter Physics Dept. at UAM, the National Institute of Standards and Technology (NIST USA), the French Atomic Energy Commission (CEA France) and the Catalan Institute of Nanoscience and Nanotechnology (ICN2). Over his career, he has built a solid background in ultrahigh vacuum techniques, 2D heterostructure fabrication, transport at cryogenic temperatures, spin-torque, and magnetization dynamics. He has been mentored and trained by world-leading scientist in the field of condensed matter physics and spintronics such as Arkady Levanyuk (Emeritus Prof. UAM), Bernard Dieny (CEA/Spintec), William E. Bailey (Associate Prof. Columbia), William H Rippard (NIST) and Sergio O. Valenzuela (ICREA Prof. ICN2).

Juan F Sierra's current research interest includes quantum materials, novel physical phenomena in van der Waals heterostructures and device-level integration. His work in this field has been published in influential peer-reviewed journals including Nature Materials (IF 39.2), Nature Nanotechnol. (IF 37.4), Nature Phys. (IF 22.7), Nature Commun. (IF 12.2), Nano Lett. (IF 13.7), Phys. Rev. Lett (IF 7.5) 2D Materials (x2 IF 7.0) and one invited research update article in APL Materials. Besides he holds one European patent.

Juan F Sierra has secured competitive project and grant funding (> 0.5 M) being principal investigator (PI) of one National MINECO project oriented to Societal Challenges (2DM2, 150 k) and co-PI of a collaborative research grant between the ICN2, the King Abdullah University of Science and Technology (KAUST) and the CEA (385 k for ICN2 partner). He also has been actively involved as contributing scientist in 2 ANR French projects, 3 Spanish "Plan Nacional de I+D+i", 1 ERC Starting Grant and the Graphene Flagship (Core 1 & 2). He was also the leading scientist of two different European funded fellowships (Marie Curie and Beatriu de Pinós), securing about 215 k to carry out his research.

The mentoring experience of Juan F Sierra includes the official supervision of 1 PhD thesis, 1 end-of-degree project, 2 internship students, and 2 PhD visitors at ICN2.

Resumen del Currículum Vitae:

Juan F Sierra is a research scientist, whose research focuses on the development of novel van der Waals heterostructures using graphene and topological insulators as tantalizing materials for spintronic and thermoelectric applications.

He earned a PhD in Condensed Matter Physics in 2008 from Universidad Autónoma de Madrid. During this period he initiated a collaboration with the National Institute of Standards and Technology (USA) to work out on the interfacial properties of magnetic tunnel junctions that are being developed for magnetic data storage and sensor applications.

After receiving his PhD, Juan F Sierra worked at the French Atomic Energy Commission in the Research Laboratory SPINTEC, first with a CNRS postdoctoral contract (2009) and then funded by a highly competitive research fellowship IEF-Marie Curie (2010-2012). His research during this period concentrates on the study of the spin-transfer-torque phenomena in nanoscale magnetic tunnel junctions and metallic spin valves. The research was carried out in collaboration with industrial partners (Hitachi and Leti).

After his postdoctoral research in France, Juan F Sierra joined the group of Sergio O. Valenzuela in Barcelona. There, he was awarded first a Beatriu de Pinós and then Juan de la Cierva Fellowships. Since joining ICN2, he has devoted his efforts entirely to spintronics and thermoelectricity in graphene and topological insulators. His work has been featured in high-impact journals including Nature Mat., Nature Nanotech., Nature Phys., Nature Commun., 2D Materials and 1 invited research update article in APL Materials. In addition, he holds 1 patent. The impact of his work in spintronics can also be gauged by the number of invited talks (7 since 2018) at international conferences and seminars at universities and national laboratories (e.g. Salamanca, IfiMAC-Madrid, Institut Néel-Grenoble, International Institute of Physics-Brazil, Politecnico di Milano, Imdea, etc.).

Juan F Sierra is principal investigator (PI) of 1 National project (Plan Nacional) and co-PI of 1 Collaborative Research Grant sponsored by the King Abdullah University of Science and Technology, securing over 0.5 M of research funding in total.

Juan F Sierra is the official supervisor of 1 PhD thesis, 1 end-of-degree project, 4 internship students and 2 PhD visitors. Besides, he has supervised the laboratory work of 2 master students and 2 PhD students and trained numerous students and young postdocs in magneto-transport experiments and device fabrication.

His synergistic activities include proposal reviewing (European Commission H2020 programme, Spanish Research Agency AEI, French Research Agency ANR), referee for high-impact journals, and organization of scientific meetings. Juan F Sierra is principal organizer of one



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mini-colloquium "Emergent phenomena in 2D systems", which will be held during the CMD2020GEFES (Madrid, Sept 2020) and committee member of the "2020 Topological Matter Conference" (San Feliu de Guixols, June 2020). He is also a local committee member of one Nicolas Cabrera Summer School ("Magnetic Nanostructures" Madrid, 2004).
He is member of the Editorial Board of Journal of Physics: Materials (IOP) and Guest Editor of the focus issues Topological Matter in Journal of Physics: Materials and Design, Characterization and Applications of 2D Materials Crystals (MPDI).



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Turno de acceso general

Nombre: MORENO SIERRA, CESAR
Referencia: RYC2019-028110-I
Área Temática: Ciencias y tecnologías de materiales
Correo Electrónico: moreno.cesar@gmail.com

Título:

Low dimensional carbon nanomaterials for biomedical applications

Resumen de la Memoria:

Dr. César Moreno [<http://ams.icn2.cat/people/cesar-moreno/>] received his degree in Fundamental Physics in 2005 by the University of Cantabria. He started his research career at the Atomic Energy Commission (CEA) in Grenoble (France), performing experimental research as undergraduate student. He earned his Ph.D in Material Physics at the Institute of Materials Science of Barcelona (ICMAB-CSIC) in 2010 and he moved as postdoctoral researcher at the Nano-engineering research center at the Polytechnic University of Catalonia (CRNE-UPC). After two years, he was awarded with a tenure track position (ICYS) at the National Institute of Materials Science (NIMS) in Tsukuba-Japan, which is a very competitive research program where ICYS fellows conduct their research based on their own ideas and initiatives, using their own research funding. NIMS is one of the leading international research centres in materials sciences, ranked No. 3 in the Citation Index for research papers in this field, also ranked No. 1 in Japan in both the number of published papers per researcher and patent applications per researcher. In this highest-level research environment, he was also promoted as permanent researcher after two evaluations and the application for the permanent position. After nearly 3 years living in Japan, he then moved back to Barcelona under a Marie Curie fellowship at ICN2, where he presently works as a senior researcher. There, his work focuses in the atomically precise bottom-up synthesis and advanced characterization of low-dimensional carbon-based nanomaterials.

The scientific contribution of Dr. Moreno has been widely recognized and acknowledged by other researchers. He accounts with a significant number of research articles in the top international peer-review scientific journals, including one published in Science journal as first and corresponding author, many of them highlighted with journal cover illustrations and outreach articles in magazines and news-feed websites. Dr. Moreno has supervised numerous research projects for undergraduate, Master and PhD students of very different backgrounds, including physics, engineering and chemistry. Also, he participates in the peer-review of research articles, and he participated in the scientific evaluation of proposals for the Poland Research Agency.

He leads an independent research line dedicated to the development of new carbon nanostructured materials for applications in nanoelectronics, biosensors and advanced filtration. He has recently obtained two European projects, one as coordinator and PI (LEGOCHIP, FLAG-ERA JTC 2019) and a second one as PI (Ultra-fast and highly selective gas separation membranes from atomically precise nanoporous graphene from the Royal Society, UK) , contributing to consolidate his scientific maturity and independent position.

In 2018 he was awarded with the Molecule of the Year by the C&EN of the American Chemical Society and in 2019 with the Spanish Vanguard of Science award and the Distinguished Research Award by the Spanish National Research Council (CSIC).

Resumen del Currículum Vitae:

R&D projects and intellectual property

I participated in a total of 17 competitive R&D projects: 4 as PI totalling up 534k (1 EU H2020 Flag-ERA as Coordinator and PI, 1 MExT-Japan, 1 EU MSCA, and 1 The Royal Society UK), 4 as team researcher (key personnel in 3 of them) and 8 as working researcher. I also participated in R&D projects at large-scale facilities (ESRF-France, Bessy-Germany and ALBA-Spain) in 4 beamtimes, being 1 as main proposer. I contributed in 2 industrial projects and in 1 EU patent as main contributor. My work has been also recognized by obtaining very competitive fellowships (Post-doc UPC, JSPS-Japan, tenure-track ICYS-Japan, Post-doc In UPC and Marie Curie fellowships).



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Research Outputs

My publication record includes 29 scientific publications (4 under review, 2xACS Nano, 1 JACS, 1 J.Mater.Chem.C), >90% in Q1, which have attracted a total of ~580 citations (Google Scholar) and h-index of 12. I prioritised quality over quantity, as reflected in the journals where these publications have been published, which 13 works published in high impact factor (IF) journals (IF > 6). Specifically, 1 Science (IF: 41) as first and corresponding author, 2 Nano Letters (IF: 13.5) as first and/or corresponding author, 1 Nature Communications (IF: 11.4), 1 Chemistry of Materials (IF: 9.9), 1 ACS Applied Materials & Interfaces (IF: 8.1), and 1 2D Materials (IF: 6.9) among others. I am the first and/or corresponding author in ~ 50% of my published works including the most cited and relevant papers of my publication list, which accumulate more than 70% of the total citations.

My work has been featured in the Editors' Choice of Science (x2), Nature Electronics, Nano Today (IF 16.5), a Perspective in Science, 3 journal covers (Advanced Functional Materials, Nanoscale and Chemical Communications), 1 invited article and 1 invited book chapter. Because of the significance of my research, I presented a total of 62 contributions, including 23 invited (15 conferences and 8 seminars) and 21 oral contributions at international conferences. Supervision, teaching and outreach

Though still mid-career researcher (PhD in 2010), I have supervised 13 students: 2 Ph.D Thesis (1 completed), 4 Master Thesis (2 completed), 2 End-of-degree projects (completed) and 5 Internship students (completed). I have been regularly teaching of two Masters at the UAB (Nanotechnology) and the UPF-BIST (Multidisciplinary research). I regularly participated in invited talks to general public and primary schools (Nano-Researchers' Night 2019 at the Cosmo Caixa, NanoEduca at Centro de Cultura Contemporanea de Barcelona (CCCB) or the Bienal Ciudad y Ciencia at Fundación La Pedrera among others), radio, newspaper and video interviews and several laboratory seminars in the framework of ESCOLAB activities. I recently published an outreach paper in Revista Española de Física (Vol.3, Nº4, 2019).

International ongoing collaborations

I established a network of scientific collaborations with international leading researchers (U. Manchester, UK; USC-CIQUS, Spain, U. Bologna, Italy, DTU-Denmark, CNRS and Institute Neel, Grenoble and NIMS, Japan). I promoted and signed a memorandum of understanding between ICN2 and NIMS. I am coordinating two scientific events to be held in 2020: symposium of Physics of 2D Nanoarchitectonics within the EPS, and the twin workshop Barcelona-Grenoble.



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Nombre: PUJALS RIATOS, SILVIA
Referencia: RYC2019-026950-I
Área Temática: Ciencias y tecnologías de materiales
Correo Electrónico: silviapujals@yahoo.es

Título:

Peptidic supramolecular polymers for drug delivery applications guided by super resolution and electron microscopy

Resumen de la Memoria:

My scientific career is devoted to the design of novel nanomaterials for drug delivery and their study by different advanced microscopy techniques. My chemist background is crucial for the design and synthesis of more efficient and selective drug delivery systems, and my microscopist background is the key towards the characterization and evaluation of them. This unique combined profile (chemist+microscopist) is the key to obtain clues on nanomaterials key design parameters and help to advance in the field.

Since my Master and PhD at the IRB I was focused on peptidic drug delivery systems, starting with the development of a new proline-rich family of cell-penetrating peptides (CPPs). We designed more efficient CPPs both in internalization rate (J. Pept. Res, JACS, Biochem. Soc. Trans.) and stable against proteases (ChemMedChem). After their development, we were able to deliver different types of cargoes inside cells by using our CPPs (J. Control. Rel, ChemBioChem, Bioconj. Chem.).

During my postdoc in Prof. Shiroh Futaki group, ICR at Kyoto University, I was studying amphipathic peptides derived from curvature inducing proteins. The outcome was a new technology, in which a positive curvature inducing peptide can promote the internalization of a CPP with a cargo (ACS Chem. Biol, Biopolymers: Pept. Sci.).

As Research Associate in Prof. John Heuser electron microscopy facility, iCeMS-Kyoto University, I specialized in transmission electron microscopy, with the objective to elucidate drug delivery systems intracellular mechanism of entry. I was trained not only on conventional thin section preparation, but also deep etch/quick freeze EM, while learning fundamentals of cell biology and biophysics that are crucial for designing efficient nanomaterials for cell delivery.

Currently I am co-leading the IBEC's Nanoscopy for Nanomedicine group. Therein, my work focuses in the development of new self-assembly based nanomaterials for the treatment of cancer and infectious diseases, and their characterization along their journey in the body by super resolution techniques and electron microscopy. My current research lines are:

-Peptide based supramolecular polymers for drug delivery: My work is focused on peptide-based supramolecular polymers for drug delivery (Chem Comm). Until now, the synthesis of BTA required long and multistep procedures, limiting the output of the formulations of the materials. I aim at devising a new synthetic efficient strategy in which all the synthesis steps are achieved on the resin: one-pot synthesis. Also, one component multi-responsive supramolecular polymers are being developed.

-Super resolution microscopy for nanomaterials: During the last years my work has been establishing super resolution microscopy for nanomaterials (Chem Comm, Small, ACS Nano x2, Nat. Rev. Chem). I believe it is time to consolidate it as a routine technique for material chemists. Thus, I am currently studying different types of materials by SRM.

-CLEM for visualizing nanomaterials in action: Recently I have established a CLEM technique for STORM-TEM correlation (ChemBioChem), on intracellular pathogens. Now I aim to exploit this technique to study nanomaterials fate in cells and tissues. There is no CLEM option for synthetic nanomaterials, and it will be of great benefit for the material chemistry community working towards biomedical applications.

Resumen del Currículum Vitae:

Dr. Silvia Pujals is a senior researcher and co-leader of the Nanoscopy for Nanomedicine group at the Institute for Bioengineering of Catalonia, and Adjunct Professor in Biomedical Engineering of the University of Barcelona.

She obtained her PhD (Summa Cum Laude) at the Institute of Research in Biomedicine (IRB), under the supervision of Prof. Ernest Giralt, with her research focused on establishing a new family of cell-penetrating peptides. She has worked as postdoc on renowned groups for peptide chemistry (Prof. Shiroh Futaki, Institute for Chemical Research (ICR), Kyoto University) and electron microscopy (Prof. John Heuser, Institute for integrated Cell-Material Sciences (iCeMS), Kyoto University). During her stay in Japan she was awarded by competitive funds (Kyoto University Young Researchers Step Up Research Funding and JSPS Young Scientists Grant-in-Aid) and now she is the PI of a Retos I+D+i national project (SAF2016-75241-R) and a consolidated research group from Generalitat de Catalunya (SGR-Consolidated Research Group Optical nanoscopy and nanotechnology group (N2)). Also, she has presented in several national and international congresses, as invited speaker in many occasions, and she has experience training more than 20 students both in Japan and in Spain.

From February 2018 she became senior researcher and co-leader of Nanoscopy for Nanomedicine group, leading the following research lines: correlative light and electron microscopy (CLEM) for nanomaterials, solid phase synthesis for the development of supramolecular polymers and cancer-on-a-chip for screening nanomedicines. She is supervising at the moment the day-to-day tasks and research projects of 1 postdoc, 6 PhD students, 2 Master students and 3 undergraduate students.

Silvia's scientific career has been devoted to drug delivery systems and their study by different advanced microscopy techniques. Her peptide chemist background is crucial for the design and synthesis of more efficient and selective drug delivery systems, and her microscopist background is the key towards the characterization and evaluation, using super resolution microscopy and electron



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microscopy, and the combination of both (correlative approach, CLEM). This unique combined profile (chemist + microscopist) has been crucial to obtain clues on nanomaterial s key design parameters and help to advance in the field.

Until now she has published 31 scientific articles, in high impact journals such as Nat. Rev. Chem., JACS (x3) or ACS Nano (x3), with over 1250 citations (h-index=19). She has also published significant expert reviews, such as Super-resolution microscopy for nanomedicine research (ACS Nano, Pujals & Albertazzi, 2019) or Super-resolution microscopy as a powerful tool to study complex synthetic materials (Nat. Rev. Chem., Pujals et al, 2019). Also, she is the author of two book chapters and owes one patent on conjugates with colloidal stability (Patent No.08382058.9-1216). Her most recent selected scientific publications include: Uroz M. et al. (2019). Nature Materials; Delcanale P., et al. (2018) ACS Nano; Feiner-Gracia N., et al. (2017) JACS; Pujals S., et al. (2017) Chem. Comm. She has also received multiple awards including Mothers in Science by BIST Scientists (2018), Presentation and Poster Prize at iCeMS retreat in Japan (2013) and extraordinary prize for PhD (2010).



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Turno de acceso general

Nombre: ROLDAN CARMONA, CRISTINA
Referencia: RYC2019-027187-I
Área Temática: Ciencias y tecnologías de materiales
Correo Electrónico: cristina.roldancarmona@epfl.ch

Título:

FUNCTIONAL THIN FILMS FOR OPTOELECTRONIC DEVICES

Resumen de la Memoria:

Dr. Roldán Carmona obtained her Ph. D. in the Department of Physical Chemistry at the University of Córdoba (Spain) in 2014, under the supervision of Prof. Dr. Luis Camacho and Dr. Hendrik J. Bolink. The candidate studied two main topics: fundamental properties of organized Langmuir and Langmuir Schaefer monolayers investigated by interfacial spectroscopy and microscopy techniques; and thin films of semiconductors with optical and electronic activity. During her Ph. D., the applicant realized one research stay at the University of Durham (UK), as well as two research stays at the Molecular Science Institute (ICMol), in Valencia, where she performed applied research on organic electronics and photovoltaics. Dr. Roldán Carmona employed a large array of experimental techniques focused on understanding the structure at the nanoscale. She received the Doctorate Extraordinary Award of the University of Córdoba in 2016.

In 2015, Dr. Roldán Carmona joined the École Polytechnique Fédérale de Lausanne (EPFL) (Switzerland) as a postdoctoral researcher under the supervision of Prof. Dr. Michael Graetzel and Prof. Dr. M.K. Nazeeruddin. She extended her investigations on optically active materials for photocurrent generation and sensing, focusing on their crystallographic structure and molecular interactions. In 2016, she moved to the new Energypolis Campus (EPFL), as postdoctoral scientist at the Group of Molecular Functional Materials (GMF) led by Prof. M. K. Nazeeruddin. The applicant used her knowledge about fundamental physical chemistry of interfaces and organized films to explore novel concepts in semiconductors design, towards enhanced electrostatic interactions and self-assembled interfaces. Part of these results were published in high impact factor journals like Nature Communications and Nature Energy. In 2017, she was beneficiary of Juan de la Cierva- Incorporación Fellowship.

Since 2016, the applicant has supervised the research activities of more than 10 long-term visitor scientists and Ph.D students from international institutes and universities. She is currently supervising a Ph. D. student at EPFL, exploring alternative techniques to grow crystalline films with nanometric control. She has participated in 15 national and international projects, 5 of them funded by the European Commission within the Seventh Framework Program (FP7) and Horizon 2020 (H2020), as well as Asian Research Institutes such as the National Priority Research Program of Qatar. At present, she is principal investigator of 4 them.

Resumen del Currículum Vitae:

Dr. Cristina Roldán Carmona is a senior scientist at the Ecole Polytechnique Federale de Lausanne (EPFL), where she leads the research line on Perovskite Photovoltaics and Functional Materials. In 2014, she completed her Ph.D in Physical Chemistry with "Cum Laude" qualification, holding the Formación de Profesorado Universitario (F.P.U)-Fellowship. In 2016 she was awarded a "Ph.D Excellence Prize". After completing her studies, in 2015 she got a postdoctoral position at the École Polytechnique Fédérale de Lausanne (EPFL, Switzerland), joining the laboratory of Prof. M. Graetzel and Prof. M. K. Nazeeruddin. Later in her career (2016), she moved to Energypolis Center EPFL-Valais, and she also became the Safety Delegate (COSEC) at her research unit. In 2017 she was awarded a Juan de la Cierva Incorporación Fellowship, ranked 3/15 in Material Sciences and Technology. She is at present senior scientist at SCI-SB-MN Group EPFL-Valais, where she has supervised the research activity of 11 Ph.D students and visitor scientists since her incorporation.

Cristina Roldán Carmona is interested in the photo physics of organized thin films, focusing on the impact of their molecular arrangement on optoelectronic properties. She has investigated self-organized crystals combining organic and inorganic components, with application on thin film optoelectronics. At present, she works in functional semiconductors and advanced architectures for photovoltaic devices, targeting fundamental aspects about performance losses and their degradation mechanism. Co-author of 47 publications (with 4 additional submitted) published in high impact factor journals (Nature Energy, Nature Communications, Energy Environmental Science, Advanced Materials, Advanced Energy Materials, or JACS among others), she has an H-index of 23, a total number of cites of 2697 and 3 patented works (with an additional work-patent in process).

She has participated in 15 national and international projects (5 under H2020, FP7 and 1 under the National Priority Research Program of Qatar). She is principal investigator in 1 competitive Swiss Seedgrant from Tech4impact-EPFL; 2 industrial research projects with Toyota Motor Europe Technical Center; and 1 project co-funded by the German Research Foundation and Swiss National Science Foundation. In addition, she has 4-years undergraduate teaching experience (23 credits ECTS), involving frontal lectures and practical hours. She has been guest-researcher in several national and international institutes like Centre for Molecular and Nanoscale Electronics (Durham, UK), Instituto de Ciencia Molecular (Valencia, Spain), Deutsches Elektronen-Synchrotron DESY (Hamburg, Germany), Swiss Federal Laboratories for Materials Science and Technology EMPA (Zurich, Switzerland) or Instituto de Ciencias Exactas y Naturales (Medellin, Colombia).



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Nombre: CARIDAD HERNANDEZ, JOSE MANUEL
Referencia: RYC2019-028443-I
Área Temática: Ciencias y tecnologías de materiales
Correo Electrónico: caridajm@tcd.ie

Título:

Gapped Dirac materials for quantum technologies

Resumen de la Memoria:

I am an experimental physicist specialized in optical and electronic properties of novel nanomaterials, including 2D materials and metallic nanoparticles.

My main research line is devoted to quantum confinement effects in novel materials and nanodevices. Among others, I have undertaken quantum transport studies in periodically modulated graphene and quasi-1D graphene nanodevices.

My mid/long-term goal is to experimentally assess the potential of gapped Dirac materials (GDMs) for quantum technologies. These novel materials are an exciting subclass of 2D crystals including silicene or germanene; systems where (unlike bare graphene) electrostatically confined quantum dots can be realized. Specifically, I aim to i) realize and measure coherence and relaxation times of spin/valley quantum bits (QB) in GDMs and ii) individually couple any two QB within an array while other QBs remain decoupled. The latter feature, uniquely predicted to occur in materials with quasi-relativistic spectrum such as GDMs, eases the realization of scalable, fault-tolerant quantum computing.

Resumen del Currículum Vitae:

I am a seasoned experimental physicist specialized in the design and characterization of optical and electronic devices made from novel materials, including quantum systems. I have an interdisciplinary scientific (MSc 2008, PhD 2014) and engineering (BEng 2005) background which allows me to understand and exploit outstanding properties of nanomaterials towards current technological challenges.

My current position is senior research fellow at Lund University (Sweden), supported by a personal grant. I have had 4 additional affiliations: U. Salamanca, Spain and U. Pavia, Italy as research assistant (2009); Trinity College Dublin TCD, Ireland as PhD student (2010-2014) and the Technical University Denmark, DTU, Denmark as postdoc (2014-2017) and (fixed-term) Assistant Professor (2018-2019).

I have authored 1 book chapter, 23 articles, some of them published in high-impact journals such as Nature Nanotechnology, Nature Communications(x4), or NanoLetters. I have contributed to 20+ conferences/seminars, 9 as invited speaker. Among others, my work has led to 2 patents, 3 R&D awards (Spain'05,'06, EU 18) and 1 innovation prize (Ireland '12). I have secured >240K to undertake R&D projects in academic institutions as well as in collaboration with industry. I have supervised 9 students at BSc/MSc/PhD levels and have taught courses at BSc and MSc levels in TCD and DTU. Also, I have designed, installed and managed multiple-user laboratory facilities, including a quantum transport laboratory during my postdoctoral period.



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Nombre: GOMEZ ROCA, ALEJANDRO
Referencia: RYC2019-027449-I
Área Temática: Ciencias y tecnologías de materiales
Correo Electrónico: alejandrogroca@gmail.com

Título:

Multifunctional Magnetic-based nanostructures for biomedical applications

Resumen de la Memoria:

During the 14 years of scientific research of the RyC candidate Alejandro Gómez Roca (AGR) he has gained a multidisciplinary background in the field of physics, chemistry, material science and biology. During his PhD (2006-2009) he developed novel methodologies for the synthesis of magnetite nanoparticles with precise size, high crystallinity and narrow size distribution through thermal decomposition. Moreover, he was able to transfer the particles in aqueous media by ligand exchange. The particles resulted to be highly biocompatible and led to powerful tools for drug delivery (conjugation with IFN- γ ;) and magnetic resonance imaging (MRI).

After defending his PhD, he moved to Zaragoza (209-10) and worked in two different institutions. In 2009 he worked at the Instituto de Nanociencia de Aragón. He gained experience in other synthetic routes, like the polyol process, and get more experience with hydrophilic polymer coatings to prepare ferrofluids for MRI. In 2010 I moved to ICMA-CSIC (supervised by Cristina Piquer) and was introduced to synchrotron techniques such as x-ray absorption (XANES) and x-ray magnetic circular dichroism (XMCD), to get a deeper knowledge of magnetic materials regarding their structural and magnetic properties.

At the end of 2010 he moved to The University of York to study the magnetic properties of ferrofluids and the heat dissipation mechanisms of the magnetite nanoparticles in magnetic hyperthermia. During this time, he was involved in the built up of a AC magnetic susceptometer. There he collaborated with Liquids Research Ltd, where he worked after his stay at York (end of 2012).

In 2013 he started to work at the ICN2. During this time he expanded my research to the study of the synthesis and properties of other magnetic materials such as Mn₃O₄, MnO/Mn₃O₄, Fe₃O₄/Mn₃O₄ and Mn₃O₄/Fe₃O₄ core/shell systems and CoO. Moreover, he started to characterize the properties of such materials by neutron diffraction and small-angle x-ray scattering. He also expanded my expertise to the synthesis of multifunctional magneto-plasmonic nanoparticles (Au-Fe₃O₄) and anisotropic nanoparticles (rods, cubes).

In summary, the nature of his research spans two research lines related with magnetic iron oxide- based nanoparticles. His main research line is the development of novel synthetic methodologies of magnetic-based nanoparticles for biomedicine with an accurate control over the size, shape and interphase features. His target materials range from hybrid heterostructures with magnetic and optical domains and the synthesis of anisotropic magnetic nanoparticles like magnetite nanocubes or nanorods, with direction-dependent properties. He is focused on the evaluation of all of these nanomaterials for their performance in biomedical application (contrast agents in different imaging techniques or nanoheters in magnetic and/or optical hyperthermia).

Dr. Roca is also focused on the study of the structure and magnetism of magnetic-based nanostructures. During this study, he combines different lab-scale techniques together with synchrotron/neutron techniques that lead to the complete understanding of the structure and magnetism of nanomaterials. He started to study the Fe₃O₄ magnetism with size, oxidation state and expanded the range of studied materials to bi-magnetic nanostructures (Fe₃O₄ with Mn₃O₄ or with FeO).

Resumen del Currículum Vitae:

Dr. Alejandro G. Roca has worked in different research centres from Spain (ICMM-CSIC, INA-UNIZAR, ICMA), United Kingdom (University of York) and Japan (Tohoku University), and also in the private sector (Liquids Research). Currently, he works at the Institut Català de Nanociencia i Nanotecnologia (ICN2). During his career he has been awarded with different fellowships at national (Beca de Colaboración, Beca I3P Postgrado, Postdoctoral Fellowship for Overseas Mobility, Beatriu de Pinós) and international level (Japanese Society for the Promotion of Science, Japan).

He holds a scientific record of 49 publications, 65% in Q1 journals, (Nano Letters, ACS Nano, Advanced Drug Delivery Reviews, Chemistry of Materials, Physics Reports, Small, Nanoscale and Nanomedicine). His work has been cited more than 2500 times with 9 publications being cited more than 100 times leading to an h-number of 24. He is the main author (corresponding author, first/second author) in 45% of them. Also, he has authored 2 patents, 1 book chapter and regularly collaborates with technological companies in the framework of preparation of ferrofluids, characterization of structural properties or design of equipment.

He is the unique Principal Investigator of 2 funded project (Ramón Areces Foundation, 89.1k €, and Spanish National Grant call for young researchers, 157k €) getting a total amount of 250k €, and also participated in 14 national and European projects. Moreover, he has a high-success record of proposals accepted (submitted as PI) at synchrotron/neutron installations.

His work has been presented in more than 60 conferences, where he has given 12 oral talks, being 9 as Invited Speaker and 1 as Plenary) in different national/international conferences such as Magnetic Carriers Conference, Intermag, EMN Open, IUMRS-ICEM or CC3DMR. He directed 1 PhD student and 3 BSc students.

He has been involved in the organization of different scientific events, from departmental seminars to workshops and symposiums at high-



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reputed conferences (IUMRS-ICEM). He is also a scientific evaluator of projects for national grant calls from Croatia, Argentina and Spain (belongs to the panel of experts of the Agencia Española de la Investigación), conferences (peer-reviewing abstracts) and journals (scientific papers). Moreover, he has been in the referee panel of the Master of Nanoscience and Nanotechnology of the Universitat Autònoma de Barcelona..

He has been Associated Professor at the Universitat Autònoma de Barcelona giving lectures at the Nanoscience Degree and Chemical Engineering Degree. He is accredited as Tenure-track lecturer and Researcher by AQU (Agència per a la Qualitat del Sistema Universitari de Catalunya).

He has been involved in different activities regarding science dissemination to students and general public (Science week, guided visits to lab for high-school students, and also writing-up articles accessible for general public. He was member of the IEEE Magnetic Society and currently he belongs to the Real Sociedad Española de Química, UK-JSPS Alumni Association.