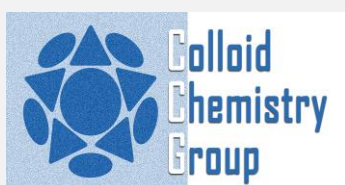


COLLOID CHEMISTRY GROUP



Universidade de Vigo

Annual Research Report **2016**



From left to right :Jorge Pérez-Juste, Laura Valencia Matarranz, Pablo Hervés Beloso, Gustavo Bodelón González, Sarah De Marchi Lourenço, Daniel García Lojo, Alba Vazquez Arias, María José Cordero Ferradás, Sergio Rodal Cedeira, Paulo Pérez Lourido, Emilia Garcia Martínez, Veronica Montes García, José A. Cuadrado Martín, Isabel Pastoriza Santos

RESEARCH PROGRAM

The research activity of the Colloid Chemistry Group is focused on the synthesis and formation mechanisms of metal, semiconductor, magnetic and hybrid nanoparticles with controlled composition, size and morphology; the creation of colloidal composites, including functionalized carbon nanotubes; nanostructured thin films and nanoparticle ordered arrays in two and three dimensions; the optical characterization of nanoparticles and their assemblies; and the use of metal nanoparticles as biosensors.

Extenal Collaborators

Fabrice Vallée (CNRS, Lyon)	Natalia del Fatti (U. Lyon, France)
Sara Bals (U. Antwerp)	Niek Buurma (Cardiff U., UK)
Salvo Sortino (U. Catania, Italy)	J. Leng and Sergio Gómez Graña (Université Bordeaux)
Andrés Guerrero (U. Complutense, Madrid)	José M. Taboada (U. Extremadura)
Manfred Stamm (Technische Universität Dresden)	Rafael Contreras (U. Málaga)
Hossein Tavakol (Isfahan University of Technology)	Sara Abalde (U. Cambridge, UK)
Patricia Taladriz (U. Campinas)	Lakshminarayana Polavarapu (L-M Universt. München)

Collaborators at Universidade de Vigo

Ángel Rodríguez de Lera (Organic Chemistry)
Africa Gónzalez (Immunology)
Elisa González (Analytical Chemistry)
Pío Gonzalez (Applied Physics)
Fernando Obelleiro (Teoría de la señal)

Staff Members

Pablo Hervés-Beloso	Isabel Pastoriza-Santos
Jorge Pérez-Juste	Paulo Pérez-Lourido
Laura M. Valencia Matarraz	Emilia García Martínez
Luis M. Liz-Marzán (on leave CIC Biomagune, San Sebastián)	

Postdoctoral Researchers

Gustavo Bodelón Gonzalez	Celina Costas Iglesias (June 2016)
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Ph. D. Students

Veronica Montes Garcia
Marc Coronado-Puchau (February 2016)
Ana Claudia Lobao do Nascimento (January 2016)
Sergio Rodal Cedeira
Sarah de Marchi Lourenço
M. Goretti Castro Justo
Daniel Garcia Lojo

Master Students

Alberto Conde

Lab. Technicians

Cristina Fernández López (July 2016)
M. José Cordero Ferradas

Administration

José Antonio Cuadrado Martín

Visiting students to conduct experiments or extend collaboration

Monja Gimber

Johanna Schüttler

Research Visitors/ Seminars

Sergio Gómez-Graña (Universidad Complutense)

Thomas Hendel (Humboldt-Universität Berlin)

M. Carmen Blanco López (Universidad de Oviedo)

Stefanos Mourdikoudis (University Pierre et Marie Curie –Paris 6)

Celia Cabaleiro Lago (Lund University)

Research Funding

ERC (*Plasmaquo*)

Ministerio de Economía y Competitividad

Xunta de Galicia

Universidade de Vigo

Agencia Española de Cooperación Internacional

Fundacion Ramón Areces

Awards

Luis M. Liz Marzán

Member of the European Academy of Sciences (EURASC)

PhD Thesis

Ana Claudia Lobao de Nascimento

Nanocomposites: Synthesis, characterization and catalytic activity

University of Vigo, January 2016

Director: Isabel Pastoriza Santos

Marc Coronado Puchau

Biosensing using metal nanoparticles

University of Vigo/CIC BiomaGUNE, February 2016

Director: Luis M. Liz Marzán and Jorge Pérez Juste

Editorial Activity

Jorge Pérez Juste

Editorial Board of Nanomaterials (MDPI)

Editorial Board of Journal of nanomaterials (Wiley-Hindawi)

Guest Editor of Israel Journal of Chemistry (Wiley)

Isabel Pastoriza Santos

Guest Editor of Israel Journal of Chemistry (Wiley)

Invited Lectures at Conferences, Courses and Workshops

Isabel Pastoriza-Santos

Self-assembly of gold nanoparticles as highly efficient SERS-active substrates for catalysis and sensing.
2nd International Symposium on Nanoparticles/Nanomaterials and Applications (ISN2A 2016)
Caparica (Portugal), 18-21 January, 2016

Nanopartículas plasmónicas de Pd: Catálisis y detección
Seminario Espectroscopia Atómica y Nuclear Avanzada de Agilent Technologies
Vigo (Spain), 19 February, 2016

Design of plasmonic nanostructures for bioimaging and sensing
International Iberian Nanotechnology Laboratory (INL)
Braga (Portugal), 24 June, 2016

Multiplex detection and imaging of tumor cells using gold-based SERS platforms
The 7th International Conference on Metamaterials Photonic Crystals and Plasmonics (META'16)
Málaga (Spain), 25-28 July, 2016

Plasmonic nanostructures for catalysis and sensing
Applied Nanotechnology and nanoscience International Conference
Barcelona (Spain), 9-11 November 2016

Jorge Pérez Juste

SERS tags for multiplex immunophenotyping cellular receptors
252nd American Chemistry society national Meeting
Philadelphia (USA), 21-25 August, 2016

Plasmonic nanostructures for surface enhanced RAMAN spectroscopy (SERS) based bioimaging and biosensing
Department of Biochemistry and Structural Biology, Lund University
Lund (Sweden), 14 June, 2016

Pablo Hervés Beloso

Gold nanoparticles as catalyst of redox reactions
EMN Meeting on smart and multifunctional Material
Berlin (Germany), 23-26 August, 2016

Presentations and Conferences by Group Members

Gustavo Bodelón González

Surface-enhanced Raman spectroscopy for monitoring interspecies chemical interactions regulated by bacterial quorum sensing

International Conference on Self-Assembly in Confined Spaces (SACS 2016)
Donosti (Spain), 25-27 October, 2016

Verónica Montes Garcia

Supramolecular mediated self-assembly of gold nanoparticles for selective SERS detection
Conferencia Española de Fotónica (CEN2016)
Valencia (Spain), 20-22 June, 2016

Self-assembly of gold nanoparticles mediated by supramolecular chemistry for selective SERS detection
International Conference on Self-Assembly in Confined Spaces (SACS 2016)
Donosti (Spain), 25-27 October, 2016

Pillar[5]arene mediated self-assembly of gold nanoparticles for selective SERS detection (**Poster**)
Nanoscience with Nanocrystals, Nanax7
Malaga (Spain), 4-8 April, 2016

Sarah de Marchi Lourenço

Metallic nanoparticles@ZIF-8 hybrids as SERS tags for bioapplications
III Reunión de Jóvenes Investigadores en Coloides e Interfases (JICI III)
Madrid (Spain), 13-14 October, 2016

Metal nanoparticles@metal-organic frameworks. Synthesis and evidences of molecular diffusion beyond aperture size limit (**Poster and Oral Presentation**)
2nd International Symposium on Nanoparticles/Nanomaterials and Applications (ISN2A 2016)
Caparica (Portugal), 18-21 January, 2016

Sergio Rodal Cedeira

Au@Pd nanorods: new plasmonic material for sensing and catalysis
2nd International Symposium on Nanoparticles/Nanomaterials and Applications (ISN2A 2016)
Caparica (Portugal), 18-21 January, 2016
(Excellent Shotgun Presentation Award)

Au@Pd Plasmonic nanoparticles with improved sensing and catalytic capabilities
III Reunión de Jóvenes Investigadores en Coloides e Interfases (JICI III)
Madrid (Spain), 13-14 October, 2016

Outreach Activities

“Metal nanoparticles and their applications” Verónica Montes García/Daniel Garcia Lojo/Sergio Rodal Cedeira
Scientific outreach “Science Week” CINBIO/University of Vigo
10-17 November, 2016

“Days of approach to chemistry” for students of Secondary Education. Isabel Pastoriza Santos
Faculty of Chemistry / University of Vigo
October-December 2016

Workshops “They do science” for students of Secondary Education. Isabel Pastoriza Santos
“International day of women in science” University of Vigo
11 February 2016

1. M. A. Casado-Rodriguez, M. Sanchez-Molina, A. Lucena-Serrano, C. Lucena-Serrano, B. Rodriguez-Gonzalez, Manuel Algarra, Amelia Diaz, M. Valpuesta, J. M. Lopez-Romero, J. Perez-Juste, R. Contreras-Caceres, Synthesis of Vinyl-Terminated Au Nanoprisms and Nanooctahedra Mediated by 3-Butenoic Acid: Direct Au@pNIPAM Fabrication for Improved SERS Capabilities *Nanoscale*, **2016**, 8, 4557-4564, DOI: 10.1039/C5NR08054A
2. S. Mourdikoudis, T. Altantzis, L.M. Liz-Marzán, S. Bals, J. Pérez-Juste, I. Pastoriza-Santos, Hydrophilic Pt Nanoflowers: Synthesis, Crystallographic Analysis and Catalytic Performance *CrystEngComm*, **2016**, 18, 3422 – 3427, DOI: 10.1039/C6CE00039H
3. G. Zheng, S. de Marchi, V. López-Puente, K. Sentosun, L. Polavarapu, I. Pérez-Juste, E.H. Hill, S. Bals, L.M. Liz-Marzán, I. Pastoriza-Santos, J. Pérez-Juste, Encapsulation of Single Plasmonic Nanoparticles within ZIF-8 and its SERS Analysis of MOF Flexibility *Small*, **2016**, 12, 3935-3943, DOI: 10.1002/smll.201600947
4. M. Grzelczak, A. Sánchez-Iglesias, H. Heidari, S. Bals, I. Pastoriza-Santos, J. Pérez-Juste, L.M. Liz-Marzán Silver Ions Direct Twin Plane Formation During the Overgrowth of Single Crystal Gold Nanoparticles *ACS Omega*, **2016**, 1 (2), 177–181, DOI:10.1021/acsomega.6b00066
5. G. Bodelón, V. Montes-García, V. López-Puente, E. H. Hill, C. Hamon, M. N. Sanz-Ortiz, S. Rodal-Cedeira, C. Costas, S. Celiksoy, I. Pérez-Juste, L. Scarabelli, A. La Porta, J. Pérez-Juste, I. Pastoriza-Santos and L. M. Liz-Marzán, Detection and imaging of quorum sensing in *Pseudomonas aeruginosa* biofilm communities by surface-enhanced resonance Raman scattering *Nature Materials*, **2016**, 15, 1203-1211, DOI: 10.1038/nmat4720
6. L. Polavarapu, D. Zanaga, T. Altantzis, S. Rodal-Cedeira, I. Pastoriza-Santos, J. Pérez-Juste, S. Bals, L.M. Liz-Marzán, Galvanic Replacement Coupled to Seeded Growth as a Route for Shape-Controlled Synthesis of Plasmonic Nanorattles *J. Am. Chem. Soc.*, **2016**, 138 (36) 11453–11456, DOI: 10.1021/jacs.6b06706
7. A. Lombardi, M.P. Grzelczak, E. Pertreux, A. Crut, P. Maioli, I. Pastoriza-Santos, L.M. Liz-Marzán, F. Vallée, N. Del Fatti, Fano Interference in the Optical Absorption of an Individual Gold-Silver Nanodimer *Nano Lett.*, **2016**, 16, 6311-6616, DOI:10.1021/acs.nanolett.6b02680
8. G. Castro, M. Regueiro-Figueroa, D. Esteban-Gómez, P. Pérez-Lourido, C. Platas-Iglesias, L. Valencia, Magnetic Anisotropies in Rhombic Lanthanide(III) Complexes Do Not Conform to Bleaney's Theory *Inorg. Chem.*, **2016**, 55 (7), 3490–3497, DOI: 10.1021/acs.inorgchem.5b02918
9. Y. Xing, A. K. Jindal, M. Regueiro-Figueroa, M. Le Fur, N. Kervarec, P. Zhao, Z. Kovacs, L. Valencia, P. Pérez-Lourido, R. Tripier, D. Esteban-Gómez, C. Platas-Iglesias, A. Dean Sherry, The Relationship between NMR Chemical Shifts of Thermally Polarized and Hyperpolarized ⁸⁹Y Complexes and Their Solution Structures *Chem. Eur. J.*, **2016**, 22, 16657–16667, DOI:10.1002/chem.201602901

Research Publications

10. S. Rodal-Cedeira, V. Montes-García, L. Polavarapu, D. Solís, H. Heidari, A. La Porta, M. Angiola, A. Martucci, J. Taboada, F. Obelleiro, S. Bals, J. Pérez-Juste, I. Pastoriza-Santos, Plasmonic Au@Pd nanorods with boosted refractive index susceptibility and SERS efficiency: A multifunctional platform for hydrogen sensing and monitoring of catalytic reactions
Chem. Mat., **2016**, 28(24)9169-9180, DOI : 10.1021/acs.chemmater.6b04941
11. Enrique Carbo-Argibay, Stefanos Mourdikoudis, I. Pastoriza-Santos, J. Pérez-Juste, Chapter 2: Nanocolloids of Noble Metals.
Nanocolloids: A Meeting Point for Scientists and Technologists , **2016**, 37-73
12. I. Pastoriza-Santos, M. Grzelczak and J. Pérez-Juste, Special Issue: Controlled Nanocrystal Growth
Isr.J.Chem, **2016**, 56, 194, DOI: 10.1002/ijch.201610001

Abstracts of Selected Publications

Small, 2016, 12, 3935-3943

Encapsulation of Single Plasmonic Nanoparticles within ZIF-8 and its SERS Analysis of MOF Flexibility

G. Zheng, S. de Marchi, V. López-Puente, K. Sentosun, L. Polavarapu, I. Pérez-Juste, E.H. Hill, S. Bals, L.M. Liz-Marzán, I. Pastoriza-Santos, J. Pérez-Juste



The encapsulation of single plasmonic nanoparticles within ZIF-8 is presented by I. Pastoriza-Santos, J. Pérez-Juste, and co-workers on page 3935. Different surfactant-stabilised plasmonic nanoparticles were encapsulated within ZIF-8 nanocrystals. The plasmonic core allowed the study of the transport of different guests inside the ZIF-8 shell by means of surface-enhanced Raman scattering (SERS). The flexibility of the ZIF-8 shell is demonstrated through the diffusion of molecules larger than the nominal aperture size.