

NARCÍS MESTRES ANDREU

Research Scientist

Institut de Ciència de Materials de Barcelona, ICMAB
Consejo Superior de Investigaciones Científicas, CSIC
Campus UAB, 08193 Bellaterra, Catalonia (SPAIN)

<https://icmab.es/superconducting/superqmat>

Phone: +34 5801953 ext. 227

narcis.mestres@icmab.es

Researcher ID: B-5305-2013

ORCID code:0000-0001-6468-4227

ACADEMIC APPOINTMENTS AND EDUCATION

Research Scientist ICMAB-CSIC (2003-)

Tenured Scientist ICMAB-CSIC (1993-2003)

Associated Professor, Universidad Autónoma de Madrid, UAM (1989-1993)

Research Fellow, Physics Department, The University of Michigan, Ann Arbor, Michigan (USA)
1987-1989

Post-doctoral Fellow Max-Planck-Institut für Festkörperforschung, 1987

Doktor der Naturwissenschaften, Max-Planck-Institut für Festkörperforschung und Stuttgart
University (Germany), 1986

B.S. in Physics (with honors), Universitat Autònoma de Barcelona (UAB), June 1982.

CV SUMMARY

My research interests have shifted over the years, but have always focused on the study of the composition, structure, and physical properties of materials designed for specific applications (especially electronic and optoelectronic), with an emphasis on their control and optimization.

At the beginning of my career, my areas of expertise included optical spectroscopy techniques and, in particular, Raman scattering. I have used inelastic light scattering to study electronic excitations, phonons, and electron-phonon coupling in a wide range of systems such as semiconductors and semiconductor superlattices and quantum wells, mixed-valence compounds, High-Tc superconductors, and carbon allotropes.

More recently, I have addressed the study of thin films and nanostructures of functional oxides with potential impact in electronics, energy saving, and environmental science. In particular, current research topics include the synthesis of functional oxide layers and nanostructures from more environmentally friendly chemical solution deposition methods. International visibility in the field with relevant publications and the organization of several international thematic conferences. Particular attention has been paid to the study of correlated oxides, hybrid magnetic-superconductor systems, and meta-materials.

SCIENTIFIC & TECHNICAL CONTRIBUTIONS

More than 250 publications (6 reviews) in international journals, 6 licensed patents, organizer of 10 national and international conferences, participation in three technology transfer projects with private companies (over 320.000 €), Reviewer for national and international Funding Agencies, Guest Editor, Journal of Sol-Gel Science and Technology, ...

Selected research projects:

High-Temperature Superconductors for Next-Gen Information & Communication Technologies, HTS-4ICT, (PID2024-156025OB-I00)

Ministerio de Ciencia, Innovación y Universidades (España), co-financed by ERDF.

1/12/2025-30/11/2028; 191.250 €

High-Temperature SUPERconductors and hybrid systems for energy-efficient FUNctional devices, HTSUPERFUN (PID2021-124680OB-100).

Proyectos de Generación de Conocimiento, Convocatoria 2021.

Ministerio de Ciencia e Innovación (España).

1/09/2022-31/08/2025; 193.600 €.

Modified 2D van der Waals materials for advanced bio-applications

FRINATEK coordinated project, Research Council of Norway

01/04/2018-31/03/2021

170,000 NoK (18,500 €) ICMAB; Total Project: 9.283.000 Nok

Magnetic Metasurfaces for Sustainable Information and Communication Technologies, MetaMagic

EU, through the CHIST-ERA Program

01/01/2022 – 31/12/2025; 1.066.802 € total Project, 206.318 € (ICMAB site)

Nano-engineered REBCO Superconducting tapes for High Field Applications

EUOfusion Program (EU)

01/01/2019 – 31/12/2020; 619k€ total Project, 148.000€ (ICMAB site)

Supervisor of 1 post-doc, 13 PhD Students (+1 ongoing), 1 Master's Thesis, 9 Bachelor's Theses, 5 internships through Erasmus +

Selected supervised PhD Thesis:

Adrián Carretero Genevriér

Synthesis and Self-Assembly of 1D Manganese-Based Complex

Oxides from Template Directed Chemical Solution Deposition (November 19th, 2010).

Universitat Autònoma Barcelona (UAB), Excel·lent *Cum Laude*.

UAB Materials Science Extraordinary Award, academic year 2010-2011.

Current Position: Chargé de Recherche CNRS, Institut d'Électronique et des Systèmes UMR5214, CNRS Montpellier (France).

Hailin Wang

Epitaxial Growth of Complex Functional Oxide Thin Films by Green and Sustainable Chemical Solution Method. (December 15th, 2020).

Universitat Autònoma Barcelona (UAB), Excel·lent *Cum Laude*

Current Position: Scientist at Harbin Institute of Technology (HIT), China.

Alejandro Fernández Rodríguez

Field-Induced Reversible Tuning of Oxygen Doping in High-Temperature Superconductors (April 4th, 2022).

Universitat Autònoma Barcelona (UAB), Excel·lent, *Cum Laude*

Current Position: Process integration engineer, IMEC, Leuven (Belgium).

LEADERSHIP

Leadership in the synthesis of functional oxides, epitaxial thin films, and nanostructures from environmentally friendly chemical solution deposition methods. International visibility on the field with relevant publications and review articles (*Ferromagnetic 1D oxide nanostructures grown from chemical solutions in confined geometries*, Chemical Society Reviews 43, 2042-2054 (2014)), organization of several international thematic conferences, and more than 8 invited conferences on the subject (E-MRS, Materials Science and Technology Conference MS&T, Energy Materials, Nanotechnology Meeting,). Also, scientific dissemination publications (see A. Carretero-Genevriér, N. Mestres, *Growth of 1-D Oxide Nanostructures*,

RECENT ACHIEVEMENTS

1. Chemical route to epitaxial integration of functional oxide nanowire thin films on silicon

I have demonstrated the epitaxial stabilization of complex oxide nanowires with enhanced ferromagnetic or ferroelectric properties on silicon entirely performed by soft chemistry. Leadership, with publication in high-impact journals and reviews in the field. See, *Single crystalline $\text{La}_{0.7}\text{Sr}_{0.3}\text{MnO}_3$ molecular sieve nanowires with high temperature ferromagnetism*, JACS 133, 4053 (2011); *Direct Monolithic Integration of Vertical Single Crystalline Octahedral Molecular Sieve Nanowires on Silicon*, Chem. of Materials 26, 1019 (2014); *Ferromagnetic 1D oxide nanostructures grown from chemical solutions in confined geometries*, Chem. Soc. Rev. 43, 2042 (2014); *Crystal Engineering and Ferroelectricity at the Nanoscale in Epitaxial 1D Manganese Oxide on Silicon*, Nanoscale 13, 9615 (2021). The PhD work of Dr. A. Carretero-Genevri is included in this area, and we pursued a strong collaboration.

2. Epitaxial growth of functional complex oxide thin films by green and sustainable chemical solution methods

I have successfully established a polymer-assisted deposition (PAD) growth platform for functional oxide thin films at ICMA. The PAD is an aqueous and environmentally friendly chemical solution deposition method, that has been used to prepare epitaxial thin films of ferromagnetic and insulating ordered double perovskites ($\text{La}_2\text{CoMnO}_6$ and $\text{La}_2\text{NiMnO}_6$); *Spontaneous cationic ordering in chemical solution-grown $\text{La}_2\text{CoMnO}_6$ double perovskite thin films*, NPG Asia Materials 11, 44 (2019); *Aqueous Chemical Solution Deposition of Functional Double Perovskite Epitaxial Thin Films*, Chem. Eur. J. 26, 9338 (2020). On top of that, $\text{La}_{0.92}\text{MnO}_3/\text{Pt}$ bilayers, with excellent interfacial quality and showing spin pumping effects suitable for spintronic applications, have been grown and characterized. *Spin to charge conversion in chemically deposited epitaxial $\text{La}_{0.9}\text{MnO}_3$ thin films capped with Pt*, J. of Mater. Chem. C10, 5914 (2022). This work includes the PhD Thesis of Dr. H. Wang (Dec. 2020).

3. Quantum Phase Transitions in High Temperature Superconductor Cuprates

Together with Dr. A. Palau, we are investigating the phase diagram of cuprates, specifically examining field-induced oxygen modulation in $\text{YBa}_2\text{Cu}_3\text{O}_{7-x}$, which leads to a reversible modulation of the carrier density. This modulation can create multiple non-volatile resistance states and ultimately achieve a metal-insulator transition (MIT). Recently, we have studied the bipolar resistive switching (RS) effect in YBCO thin films, which show promise for ultra-efficient memory applications and as building blocks for neuromorphic computing and cryogenic electronics. Key publications are: *Electrochemical Tuning of Metal Insulator Transition and Nonvolatile Resistive Switching in Superconducting Films*, ACS Applied Materials & Interfaces 10, 30522 (2018); *Field-Induced Phase Transitions in Cuprate Superconductors for Cryogenic in-Memory Computing*, Small 2411908 (2025).

4. MOBILITY AND INTERNATIONALIZATION

Research stays at international centers

Research Fellow, 01/07/1987-30/06/1989

Physics Department, The University of Michigan, Ann Arbor, Michigan (U.S.A.)

Postdoctoral Research Fellow, 01/01/1987-30/06/1987

Max-Planck-Institut für Festkörperforschung, Stuttgart (Germany)

PhD Thesis, 17/01/1983- 17/12/1986

Max-Planck-Institut für Festkörperforschung, Stuttgart (Germany)

Organizer of 6 International and 4 National Conferences. Selected recent:

Organizer and Scientific Committee Member, 7th European Conference on Silicon Carbide and Related Materials, ECSCRM 2008, Barcelona, September 7-11, 2008

Co-organizer, 2014 E-MRS Spring Meeting, Symposium I: "Solution Processing and Properties of Functional Thin Films and Nanostructures", Lille (France), May 26-30.

Main organizer, 2016 E-MRS Spring Meeting, Symposium AA: "Solution Processing and Properties of Functional Thin Films and Nanostructures-II", Lille (France), May 2-6.

Collaboration with more than 16 International research groups. Selected recent:

Dr. Maria Benelmekki, Swansea University (UK), *2D systems and nanoparticles*.

Dr. A. Carretero-Genevri, IES-CNRS, Montpellier (France), *Integration of functional oxides on Si*.

Dr. Edoardo Albisetti, Instituto Politecnico di Milano (Italy), *Nanopatterning of functional oxide thin films*.

Dr. Giuseppe Celentano, ENEA Frascati (Italy), *Superconducting thin films*.

Dr. E. Ferain, It4ip S.A., Louvain (Belgium), *Track-etched polymer template scaffolds*.

Prof. A. Silhanek, Université de Liège (Belgium), *Oxygen electromigration in transition metal oxides*.

5. PUBLICATION HIGHLIGHTS

- *Ferromagnetic 1D oxide nanostructures grown from chemical solutions in confined geometries*; A. Carretero-Genevri, T. Puig, X. Obradors, and N. Mestres; Chemical Society Reviews **43**, 2042-2054 (2014)
- *Spontaneous cationic ordering in chemical solution-grown $\text{La}_2\text{CoMnO}_6$ double perovskite thin films*, H. Wang, J. Gazquez, C. Frontera, M. F. Chisholm, A. Pomar, B. Martínez and N. Mestres; NPG Asia Materials **11**, 44 (2019)
- *Dynamic magnetic properties and spin pumping in polymer-assisted-deposited $\text{La}_{0.92}\text{MnO}_3$ thin films*, H. Wang, A. Pomar, S. Martín-Rio, C. Frontera, N. Mestres and B. Martínez; Journal of Materials Chemistry C **7**, 12633-12640 (2019)
- *Direct Visualization of Current-Stimulated Oxygen Migration in $\text{YBa}_2\text{Cu}_3\text{O}_{7-\delta}$ Thin Films*, S. Marinković, A. Fernandez-Rodriguez, S. Collienne, S. Blanco Alvarez, S. Melinte, B. Maiorov, G. Rius, X. Granados, N. Mestres, A. Palau, A. V. Silhanek, ACS Nano **14**, 11765-11774 (2020)
- *Spin to charge conversion in chemically deposited epitaxial $\text{La}_{0.9}\text{MnO}_3$ thin films capped with Pt*; S. Martín-Rio, A. Pomar, C. Frontera, H. Wang, R. Manzorro, C. Magén, L. Balcells, N. Mestres and B. Martínez; Journal of Materials Chemistry C **10**, 5914-5921 (2022)
- *Crystallographic Engineering of Spin Transport in Antiferromagnetic NiO Thin Films* S. Chen, A. Pomar, L. Balcells, Z. Konstantinovic, B. Bozzo, C. Frontera, C. Magén, N. Mestres, B. Martínez, ACS Nano **19**(36), 32170–32182 (2025)
- *Strain Relief and Domain Architecture in Epitaxial NiO Films on $\text{La}_{2/3}\text{Sr}_{1/3}\text{MnO}_3/\text{SrTiO}_3$ for Spin-Transport Engineering*, S. Chen, C. Frontera, M. Toda-Casaban, A. Pomar, L. Balcells, Z. Konstantinovic, C. Magén, B. Martínez, N. Mestres Advanced Materials Interfaces **12**, e00452 (2025).
- *Field-Induced Phase Transitions in Cuprate Superconductors for Cryogenic in-Memory Computing*. T. Güntel, J. Alcalà, A. Fernández, A. Barrera, L. Balcells, N. Mestres, E. Miranda, J. Suñé, A. Palau Small **24**11908,11pp (2025).