

Part A. PERSONAL INFORMATION

CV date 8-2-2021

First and Family name	Francesca Campabadal Segura		
ID number	33863537Q	Age	61
Researcher codes	Open Researcher and Contributor ID (ORCID**)	0000-0001-7758-4567	
	SCOPUS Author ID (*)	7004481916	
	WoS Researcher ID (*)	E-6651-2014	

A.1. Current position

Name of University/Institution	Consejo Superior de Investigaciones Científicas		
Department	Institut de Microelectrònica de Barcelona Centro Nacional de Microelectrónica		
Address and Country	Carrer dels Til·lers, s/n. Campus UAB, 08193 Cerdanyola del Vallès		
Phone number	935947700	E-mail	Francesca.campabadal@csic.es
Current position	Profesora de Investigación del CSIC	From	15-3-2011
Key words	Silicon Technology, ALD, Thin dielectric layers, RRAM, memristor		

A.2. Education

PhD, Licensed, Graduate	University	Year
Licenciatura en Ciencias Físicas	Universitat Autònoma de Barcelona	1981
Doctorado en Ciencias Físicas	Universitat Autònoma de Barcelona	1986

A.3. General indicators of quality of scientific production

Number of six-year terms of research granted: 6 (last 2012-2017)

1 PhD Thesis supervised since 2010

Total number of citations - self citations excluded: 2075 (WoS)

Mean value of citations/year in the last 5 years (2016-2020): 136 (WoS)

Total number of publications in journals in the first quartile: 57/153 (WoS)

Total number of contributions to international conferences: 150

h-index = 24 (WoS)

Part B. CV SUMMARY (max. 3500 characters, including spaces)

I received the Bachelor's (1981) and PhD (1986) Degrees in Physics from the Universitat Autònoma de Barcelona. In 1987 I joined the Institut de Microelectronica de Barcelona (IMB-CNM) of the Consejo Superior de Investigaciones Científicas (CSIC) where I am currently Professor of Research. From the beginning of my career, my research has been devoted to both technology development, and fundamental research in the field of thin films of dielectric materials for electronic devices.

In terms of technology design and development, my activity has been focused in silicon-based devices and systems, first in CMOS technology and later in the field of physical sensors, in particular, piezoresistive pressure sensors, mass sensors and radiation detectors for high-energy physics experiments. Among the results achieved, I would like to highlight the monolithic integration of micromachined sensors and CMOS circuitry and the transfer of developed technologies for the fabrication of pressure sensors and their packaging to Copreci and Fagor Electronica, manufacturers of components for household appliances.

My interest in the study of thin dielectric films already started in my PhD thesis by studying the tunnelling conduction in silicon dioxide layers, and has continued all along my career. I was first responsible at IMB-CNM for the development and tuning of thermally growing silicon dioxide in conventional furnaces and in rapid thermal processing. This led us to address the study of the electrical properties of thin oxide layers, their stress- and radiation-induced degradation and their reliability as gate oxide in MOS transistors.

In view of the increased need for alternative gate oxide materials, I started a new research line in the field of high permittivity dielectric layers, specifically those grown by means of the Atomic

Layer Deposition (ALD) technique. To this end, I undertook the procurement in 2008 of the first ALD system available in Spain devoted to the deposition of HfO_2 and Al_2O_3 layers. From that moment, the group I am leading, the Advanced Thin Dielectric Films Group of the IMB-CNM, has obtained a deep knowledge of the ALD processes and has contributed significantly to the understanding of the electrical characteristics and the reliability of the ALD layers. This was an excellent starting point to start, in 2013, a new research line for the study of the resistive switching phenomenon in MIS and MIM structures based on high permittivity oxides deposited by ALD. This objective implied first the design and fabrication of devices and the development of characterization tools and methodologies that this type of electronic devices call for. Next the study of challenging questions, such as the physics behind the intrinsic variability in the electrical characteristics of the devices, their reliability or the use of them as memory cells or electronic synapses, has been addressed.

My research activity has been carried out in the framework competitive projects: 11 European (PI in 2) and 23 Spanish (PI in 9), and 8 research contracts (PI in 5). I have established strong and long-lasting collaborations with the most relevant Spanish research groups in the field: GCME-U. Valladolid, GRIDE-U. Granada, NANOCOMP-UAB, REDEC-UAB, LENS-UB, QINE-UPC, R. Picos - UIB, and with the Laboratorio de Microelectrónica-Física de Dispositivos (Prof. Adrián Faigón), Universidad de Buenos Aires.

Part C. RELEVANT MERITS (sorted by typology and from 2010)

C.1. Publications

1. M. B. González, M. Maestro-Izquierdo, F. Jiménez-Molinos, J. B. Roldán, F. Campabadal, "Current transient response and role of the internal resistance in HfO_x -based memristors", *Appl. Phys. Lett.* vol. 117, 262902 (5 pages), 2020.
2. M. Maestro-Izquierdo, M. B. González, F. Jiménez-Molinos, E. Moreno, J. B. Roldán, F. Campabadal, "Unipolar resistive switching behavior in $\text{Al}_2\text{O}_3/\text{HfO}_2$ multilayer dielectric stacks: fabrication, characterization and simulation", *Nanotechnology*, vol. 31, 135202 (10 pages) 2020.
3. D. Arumí, A. Gómez-Pau, S. Manich, R. Rodríguez-Montañés, M. B. González, F. Campabadal, "Unpredictable bits generation based on RRAM parallel configuration", *IEEE Electron Dev. Lett.* vol. 40, No. 2, pp. 341-344, 2019.
4. S. Poblador, M. B. González, F. Campabadal, "Investigation of the multilevel capability of $\text{TiN}/\text{Ti}/\text{HfO}_2/\text{W}$ resistive switching devices by sweep and pulse programming", *Microelectron. Eng.* vol. 187-188, pp. 148-153, 2018.
5. G. Martín, M. B. González, F. Campabadal, F. Peiró, A. Cornet, S. Estradé, "Transmission electron microscopy assessment of conductive-filament formation in $\text{Ni}-\text{HfO}_2-\text{Si}$ resistive-switching operational devices", *Appl. Phys. Express*, vol. 11, 014101 (4 pages), 2018.
6. A. Rodríguez-Fernández, S. Aldana, F. Campabadal, J. Suñé, E. Miranda, F. Jiménez-Molinos, J. B. Roldán, M. B. González, "Resistive switching with self-rectifying tunability and influence of the oxide layer thickness in $\text{Ni}/\text{HfO}_2/\text{n}^+-\text{Si}$ RRAM devices", *IEEE Trans. Electron Devices*, vol. 64, No. 8, pp. 3159-3166, 2017.
7. M. M. Mallol, M. B. González, F. Campabadal, "Impact of the $\text{HfO}_2/\text{Al}_2\text{O}_3$ stacking order on unipolar RRAM devices", *Microelectron. Eng.* vol. 178, pp. 168-172, 2017.
8. S. Dueñas, H. Castán, H. García, E. Miranda, M. B. González, F. Campabadal, "Study of the admittance hysteresis cycles in $\text{TiN}/\text{Ti}/\text{HfO}_2/\text{W}$ -based RRAM devices", *Microelectron. Eng.* vol. 178, pp. 30-33, 2017.
9. M. B. González, J. Martín-Martínez, M. Maestro, M. C. Acero, M. Nafría, F. Campabadal, "Investigation of filamentary current fluctuations features in the high-resistance state of Ni/HfO_2 -based RRAM", *IEEE Trans. Electron Devices*, vol. 63, No. 8, pp. 3116-3121, 2016.
10. C. Vaca, M. B. González, H. Castán, H. García, S. Dueñas, F. Campabadal, E. Miranda, L. A. Bailón, "Study from cryogenic to high temperatures of the high- and low-resistance-state currents of ReRAM $\text{Ni}-\text{HfO}_2-\text{Si}$ capacitors", *IEEE Trans. Electron Devices*, vol. 63, No. 5, pp. 1877-1883, 2016.

C.2. Research projects

- 1.- Project Reference: TEC2017-84321-C4-1-R
Title: RS-FACSIMILE2: Fabricación, caracterización, simulación, modelado y aplicaciones de dispositivos de conmutación resistiva.
Funding Agency: Agencia Estatal de Investigación
Principal Investigator: Francesca Campabadal Segura, IMB-CNM, CSIC.
Dates: From 1-1- 2018 to 31-12-2020
Funding amount: 128.260 Euros
- 2.- Project Reference: TEC2014-52152-C3-1-R
Title: RS-FACSIMILE: Fabricación, caracterización y simulación de dispositivos de conmutación resistiva basados en dieléctricos de alta permitividad.
Funding Agency: MINECO
Principal Investigator: Francesca Campabadal Segura, IMB-CNM, CSIC.
Dates: De 1-1- 2015 hasta 31-12-2017
Funding amount: 100.914 Euros
- 3.- Project Reference: TEC2014-54906-JIN
Title: VARERAM: Advanced Characterization and Modeling of Switching Variability and Reliability in Emerging Resistive Random Access Memory Devices.
Funding Agency: MINECO
Principal Investigator: Mireia Bargalló González, IMB-CNM, CSIC.
Dates: From 1-9-2015 to 31-8-2018
Funding amount: 168.300 Euros
- 4.- Project Reference: TEC2014-53909-REDT
Title: NANOVAR: Red Temática en Variabilidad en Nanoelectrónica
Funding Agency: MINECO
Principal Investigator: Montserrat Nafria Maqueda, UAB.
Dates: From 1-12-2014 to 30-11-2017
Cuantía de la subvención: 20.000 Euros
- 5.- Project Reference: TEC2011-27292-C02-02
Title: ALDSIGRAF: Fabricación y caracterización de capas de dieléctricos de alta permitividad depositadas por ALD sobre silicio y sobre grafeno.
Funding Agency: MINECO
Principal Investigator: Francesca Campabadal Segura, IMB-CNM, CSIC.
Dates: From 1-1-2012 to 31-12-2014
Funding amount: 95.382 Euros

C.3. Contracts, technological or transfer merits

- 1.-Title: Fabricación y caracterización de dispositivos MIS y MIM de conmutación resistiva.
Technological contract between UPC and IMB-CNM (CSIC)
Dates: from May 2019 to December 2019
Principal Investigator IMB-CNM: Francesca Campabadal Segura
Contract amount: 3.569,50Euros.
- 2.-Title: Fabrication of MIS and MIM structures with resistive switching performance.
Technological contract between UAB and IMB-CNM (CSIC) and D+T
Dates: from February 2015 to July 2016
Researchers of IMB-CNM: Francesca Campabadal Segura and Mireia Bargalló González
Contract amount: 4.000 Euros.
- 3.-Title: Diseño y fabricación de estructuras MIS y MIM.
Contract between UAB and IMB-CNM (CSIC) and D+T
Dates: From 7-2013 to 7-2014
Principal Investigator IMB-CNM: Francesca Campabadal Segura
Contract amount: 10.750,85 Euros.
- 4.- Title: Desarrollo y fabricación de estructuras y dispositivos microelectrónicos para el estudio del efecto de campo sobre caminos de ruptura de estructuras MOS.

Contract between UAB and IMB-CNM (CSIC)
Dates: From 20-10-2010 to 19-10-2012
Principal Investigator IMB-CNM: Francesca Campabadal Segura
Contract amount: 20.060 Euros.

C.4. Supervision of PhD and Master Theses

PhD Thesis

- “Conmutación resistiva en estructuras MIM con dieléctricos de alta permitividad”, Samuel V. Poblador Cester, UAB. To be presented in July 2021.

Master Thesis

- “Deposición por ALD y caracterización de capas de Al_2O_3 con O_3 como precursor oxidante”, Oihane Beldarrain Fernández, Master Thesis, UAB, 2011.
- “Impact of the dielectric thickness and top electrode material on the electrical characteristics of HfO_2 -based resistive random access memories”, Jordi Muñoz Gorriz, Master Thesis, UAB, 2016.

C.5. Management of the Research Activity

- Head of the Advanced Thin Dielectric Films Group of the Instituto de Microelectrónica de Barcelona del Centro Nacional de Microelectrónica del CSIC, 2008-present.
- Head of the Grupo de Micro y Nanotecnologías del Instituto de Microelectrónica de Barcelona del Centro Nacional de Microelectrónica del CSIC, 1-11-2008 - 30-4-2014.
- Head of the Departamento de Micro y Nanosistemas del Instituto de Microelectrónica de Barcelona del Centro Nacional de Microelectrónica del CSIC, from 9-2-2007 to 1-11-2008, and from 19-7-2012 to 19-7-2013.
- Member of the Comisión de Área de Ciencia y Tecnologías Físicas del CSIC, 7-2-2017 - 30-11-2018.

C.6. Participation in Committees

- Member of the Panel of Experts of the Programa de Evaluación ACADEMIA of the ANECA, in the Engineering and Architecture field. 2008 - 2016.
- Member of the Technical Committee for the evaluation and selection of project proposals of the in the area of Electronic and Communication Technologies (TEC), Electronic Technologies (TEC-MIC) in 2014.