CURRICULUM VITAE: Rodrigo Martins

PERSONAL INFORMATION

Rodrigo Martins, Portuguese, born in Angola, 15 September 1951, with ID card 8252840. Full Professor at New University of Lisbon, UNL.

Address: Materials Science Department of FCT-UNL, Campus Caparica, 2829-516, Caparica-Portugal.

https://scholar.google.co.in/citations?user=5FLD1tUAAAAJ:

Citations 38160

Index h 72 319

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Scopus: 7202166114; ISI: C-4337-2013; ORCID: 0000-0002-1997-7669.

Publications: Number of papers published: ≈1050 papers, from which ≈677 in the WoK; 2 books; editing 8 books; 1 pedagogic text book in Portuguese (\approx 900 pages); book chapters 28.

Patents: granted patents 43; 16 pending.

Talks: about 600 talks, from which 100 as plenary/key note speakers, 200 as invited and 200 as regular in main international and national conferences, symposia and workshops.

Posters: about 300 in main international and national conferences, symposia and workshops.

EDUCATION AND DEGREES

1988 Aggregation in Semiconductor Materials & Microelectronics, UNL, Portugal, Lesson: "Density of states in disordered semiconductors"; 1982 Ph.D. in Energy conversion and Semiconductors, UNL, Portugal. Thesis: "a-Si:H solar cells processing and characterization"; 1977 MSc in Semiconductor Materials, Dundee University, Scotland. Thesis: "Photoconductivity in P Doped and Undoped Amorphous Germanium." Supervisor W. Spear, 1977 Euro physicist. 1974 Honours degree in Electronics Engineering, Telecommunications and applied Electronics, U. Luanda, Angola/ PT.

RELEVANT CURRENT PROFESSIONAL EXPERIENCE

- a) Academic Responsibilities at University and Research Levels
- 2013-...Member International Board of the PhD Program in Materials in UDJG University (University of Galati). Romania:.
- 2013-...Member of: i) Steering Committee of Sino-Portuguese Joint Innovation Centre for Advanced Material; ii) External Quality Board of Master program in Functional Advanced Materials & Engineering (FAME), Grenoble-INP & U. Bordeaux FR; U. Augsburg & TU Darmstadt D; U.C. Louvain & U. Liege, B; U. Aveiro PT.
- 2013-...Coordinator of PhD program in Advanced Materials and Processing involving 7 Portuguese Universities & 12 Research Centres.
- 2006-...Administration Council Board of Institute of New Technologies, Uninova.
- 2002-...Full Professor in Microelectronics at UNL.
- 1989-...Head of the Department of Materials Science, of FCT-UNL;
- 1989-...Founder and Director of Centre of Excellence in Microelectronics and Optoelectronics Processes of Uninova;

b) Responsibilities in Scientific Institutions, Academic Associations and Government Bodies

2018-2020 President of the European Academy of Sciences;

Member of steering committee of the Co-Location Centre (central) of the Knowledge and Innovation Community (KIC) of the European Institute of Innovation and Technology (EIT) of Raw Materials;

Member of the Nomination Committee of KIC Raw Materials, representing the CLC Central;

2nd Vice-president of the International Union of Materials Research Society, IUMRS;

- 2018-2020 Member of the expert group of DG GROWTH to define the strategic agenda for Important Projects of Common European Interest.
- 2016- ... Member of the management board of Nature group, Journal npg 2D Materials and Applications.
- 2015-...Co-chair of the Energy Materials Industry Research Initiative, EMIRI.
- 2014-... Member of the technical group that assist the Portuguese National Science and Technology Foundation in establishing the research policy in the area of materials, nanotechnologies and manufacturing.-
- 2014-... Chair of the European affairs Committee of the European Materials Research Society (E-MRS); Chair of the Committee of Global Leadership and Service Award of the International Union of Materials Research Societies IUMRS.

2013-... Member of the Steering Committee of EuMat

1991-...Head of the Nanotechnologies. Optoelectronics and Electronics Materials group of CENIMAT/I3N:



PAST RELEVANT EXPERIENCE

2014-2017 Member of the Expert Advisory Board of the European program HORIZON 2020, for DG Research and Innovation (NMP);

2014-2016 President of the Senate of the European Materials Research Society, E-MRS.

Member of the Nomination Committee of MRS-USA;

- 2013-2017 Member of the International Advisory board of Strategic Initiative Materials, a Flanders industry initiative financed by the Flemish Government;
- 2013-2018 Member of the Administration Board of Alliance for Materials (A4F), a global European Platform;

2012-2016 Member of the Scientific Board Council of FCT-UNL;

2011-2013 President of the European Materials Research Society, E-MRS;

2006-2015 President of the General Board of the FCT-UNL Foundation

2004-2012 E-MRS delegate for Initiative for Science in Europe, promoter of the European Research Council;

1988 – 2001 Associated Professor at FCT-UNL.

1991-1995 Founder and 1st Director of the Materials Research Centre (CENIMAT/I3N);

SCIENCE POLICY EXPERIENCE



Signature of Arhus declaration by Director General of Research and Innovation of EU, E. Von Bose, Secretary general of A4M, M. Falzetti; the president of the Federation of European Materials Societies, E. Zschech; R. Martins, E-MRS President



November 2016, during the 2nd global leadership award that took place in the European Parliament

As President of E-MRS, followed by being president of its senate, was noticeable the success I got, as team worker, in promoting the approach of E-MRS to the European policy makers and stakeholders. Here, my great accomplishment was the approach to other societies and European platforms dealing with Materials that end up with the signature of Arhus declaration in 2012, whereby, for the first time, a common voice was heard and considered by the European Commission in the strategy for the Research and Innovation programmes, and resulted with great impact in the largest Materials Research programme in the world, within the Horizon 2020. Moreover, as member of the European Committee affairs of E-MRS I promoted the approach of the society to the European stakeholders and policy makers, translated in the involvement of the society as disseminator and reached out to over 12 European projects, where the functions of E-MRS were well appreciated, including over one million euros of benefits for E-MRS.

As landmarks I have organized > 8 meetings at the European Parliament involving policy makers and stakeholders, the <u>last in</u> <u>November 2016, during the IUMRS leadership award</u>; participating in the Initiative for Science in Europe (ISE) that launches the European Research Council under the Chair of José Mariano Gago: <u>http://www.initiative-science-europe.org/pdf/04-Science-Letter-</u>

<u>Creating-ERC.pdf</u>; responsible for organizing the 11th 2007 ISE meeting in Lisbon where F. Mayor took over as Chair of ISE , after

which commissionaire J. Potočnik turn ERC effective. Founder of <u>Institute for Nanostructures</u>, <u>Nanonodelling &</u> <u>Nanofabrication</u> & of the <u>Centre of Excellency in Materials</u>, the only Portuguese research lab working in the field of Advanced Materials and Nanotechnologies classified as Exceptional by an external review panel (top 11 in all scientific and technical areas in Portugal). The panel considered the group I coordinate "a model of European Excellency and quality in the area of electronic materials, optoelectronics and microelectronics". I also coordinate in FP6 the 1st European project in the area of electronics functional oxides, in the TOP 10 of the program. Participation in 35 academic examination boards/juries (PhD, aggregation, Full professor, abroad & Portugal in the areas of Materials, Physics and electronics). Promoter of the Materials field worldwide;

MEMBERSHIPS OF SCIENTIFIC SOCIETIES (starting date)

2017; Member of the Presidium of the European Academy of Science;

- 2012: Member of the Portuguese Engineering Academy; Member of IEEE;
- 1987 Member of the Materials Research Society; Member of the Portuguese Materials Society;
- 1974 Member of the Portuguese Professional Engineering.

PRIZES DISTINCTIONS AND AWARDS

2017 IC3TC2017 (2nd International Caparica Christmas Congress on Translational Chemistry 4th -7th December 2017) Award to a Career in Pioneering Science, award established by ProteoMass Society, December 2017, given to Elvira Fortunato and Rodrigo Martins;

Best demonstrator prize at LOPEC 2017- Large-area, Organic & Printed Electronics Convention 2017, Munchen, 28-30 May 2017, with the work iFlexys, Integrated X-ray Sensor Systems;

Elected as vice-president of the European Academy of Science.

INCM Innovation Prize 2017 (<u>Prémio Imprensa Nacional Casa da Moeda</u>), given to the work Secret paper project, (team: R. Martins, E. Fortunato, L. Pereira, P. Barquinha);

- 2016 <u>Awarded with the Gold Medal of merit and distinction by the Almada Municipality; One of 3 finalist of the European</u> patent Office Research Award 2016 with the work on paper transistor; <u>Tetra Solar</u>, <u>Innovation prize given by Exame</u> <u>Informatica</u>; Honorable Mention in the R&D category of the 8th edition of Green Project Awards, with the work Tetra Solar: energy for all.
- 2015 Demonstrator award given by OE-A (Organic and Printed Electronics Association) during the LOPEC Large-area, Organic & Printed Electronics Convention 2015, held in Munich, February 2015 to the EC project Autonomous Printed Paper Products for Labels & Electronics, A3Ple project.
- 2014 <u>Best Research award given by FCT-UNL to 3 top researchers of all Faculty, between 2010/12; Best Leadership</u> and Service award given by FCT-UNL to 3 top researchers of all Faculty, between 2010/12.
- 2012: <u>Scientific Prize of Cidade de Almada, 1st edition with work Nanotechnologies and Nanomaterials @FCT-UNL, a</u> window of opportunities opened to the world.

Prize Innovation with the work solar tiles, Energy Live Expo, Lisbon, March 2012.

Doctor Honoris Causa by University of Galati, Romania (1 April 2012).

Green awards, 2012

- 2011 Best of PSS 2011, top 12 by Wiley with the paper: Where science fiction meets reality? With oxide semiconductors! Green awards, honour Research and Innovation award with the work on paper battery.
- 2010 Portuguese Science and Technology award 2010/2011, district 1960 of the International Rotary Foundation.

The best scientific work given by Korean Industry of Display Society (KIDS), Sept. 2010: work "Paper Memory TFT", published in Journal of Information Display, 10 (4), 80-89 (2009)

2009 Printed Electronics USA 2009 Academic R&D award given to CENIMAT with the work of paper TFT.

2009 Green awards, 1st prize Research and Innovation award with the work on the paper transistor.

- 2009 Honours member of the Rotary Club of Almada.
- 2008 Scientific Professional of the Year 2008, Rotary Club of Almada, Portugal
- 2008 Paul Harris gold medal, for scientific outstanding, International Rotary Foundation
- 2008 Exame Informática prize, magazine/Portugal.

2004 Prize for Scientific Excellence given by the Portuguese Science and Technology Foundation.

SUPERVISION OF GRADUATE STUDENTS AND POSTDOCTORAL FELLOWS

2005 -2018: Postdocs: 20 (5 from Portugal. Ongoing: 8). The others from India, China, USA; Hungary, Ukraine, Bulgarian, Romanian and Italy. PhD Students: 35 (27 concluded, from which 6 abroad + 1 abroad on-going + 2). Abroad: Brazil, Romania & Iran; Master Students: 40.

EDUCATION ACTIVITIES

2013 –... Coordinator of: Initiation to Thesis Dissertation and Seminars in 5 years Engineering of Micro and Nanotechnologies (MIEMN), course of FCT-UNL/Portugal. 2012-...: Coordinator of the Energy Alternatives, Master course in Energy, FCT-UNL/Portugal. 2010-...: Creator of the 1st Portuguese 5 Years master course in Micro and Nanotechnology, FCT-UNL/Portugal. 1989-...: Coordinator of the Instrumentation course, serving the 5 years MIEMN course and the Materials and Engineering 5 years course at FCT-UNL/Portugal. 1988 – 2007: Creator and coordinator of 1st Portuguese Microelectronics course, DCM, FCT-UNL/Portugal. 1988 -...: Creator and coordinator Energy Conversion Materials and Applications course; Semiconductor Materials course, FCT-UNL/Portugal.

ORGANISATION OF SCIENTIFIC MEETINGS

2018: <u>Member of the Programme Committee of the Innovative Manufacturing in Large Area Electronics, innoLAE 2018;</u> <u>Chair of the E-MRS Spring meeting Conference</u>; 2017: <u>Chair of Symposium Y, in Paper electronics: from materials to</u> <u>applications, -MRS spring meeting, 22-26 May</u>; Chair of the Workshop, Europe in Motion, E-MRS Spring meeting, 22 May 2017. 2016: <u>Chair of the Symposium N, Materials frontier for transparent advanced electronics II (E-MRS / MRS-J</u>

bilateral symposium), E-MRS Spring meeting, 2-7 May 2016; Chair of the Workshop, Europe in Motion, E-MRS Spring meeting, 2-7 May 2016; 2015, <u>Conference Chair of the E-MRS fall meeting</u>, <u>Warsaw</u>, 15-18 September 2015; 2014 <u>Chair of Advanced Materials at the cutting edge of innovation</u>, Lets Conf. EU Presidency, Bologna/Italy. 2013 <u>Chair STOA lunch debate and Workshop on European Innovation</u>, Ecosystem for generating value. 2012 <u>Chair of Nature Materials</u> Workshop, Strasbourg, France; Chair STOA workshop on Materials Challenges. 2010 <u>Chair of TCM 2010</u>, Crete, Greece; Chair of EMRS, Spring Conference. 2008 <u>Chair Symposium B, EMRS</u>, fall meeting, Warsaw Poland. 2007 <u>Chair</u>, 1st World Materials Summit, MRS/EMF/ISE, Lisbon Portugal UE Portuguese Presidency; Chair of ISE (Initiative for Science in Europe) meeting, Lisbon, 15-16 January 2007. 2006 <u>Chair E-MRS Spring Conference</u>, Nice, France

MEMBER OF EDITORIAL BOARD OF SCIENTIFIC JOURNALS

2018-.. Member of the Editorial Board of the Journal Nanomaterials

- 2017-.. Member of the International Advisory group of the Journal of Physics D: Applied Physics;.
- **2015-...** Member of the Editorial Board of Heliyon Elsevier's new open access journal; <u>Member of the International</u> <u>Advisory Group of Euro-NanoForum2015</u> under the auspices of the Latvian presidency of the European Union.
- 2014-... International Advisory Board of the Advanced Electronics Materials (Wiley journal);

2009-...: Editorial board of: Journal of Materials; Journal of non-oxide glasses; Annals of Dunarea de JOS, Romania.

MAJOR COLLABORATIONS

I have a worldwide network involving highly reputed scientist in the fields of Materials, Nanotechnology, Electronics and Energy as: F. Priolo (U. Catania, IT); J. Morant (IREC, SP); B. Fillion (CEA, FR); Guy Eymin Petot Tourtollet (CTP, FR); Maria Smolander (VTT); A. Nathan and J. M. Kim (U. Cambridge, UK); S. Siitonen (Storaenso, FL); E. Zschech (U. Dresden, Fraunhoffer, Germany); B. Fabroni (Bologna Univ.), Outside Europe: S-H. Park (KAIST, Korea); TIT (H. Hosono), J. Wager (Oregon Univ.), R. Faria (USP, Brasil); F. Shan (Qingdao Univ., China); T. Anthopoulos (KAUST).

RESEARCH EXPERIENCE, INTERESTS AND MAJOR RESEARCH PROJECTS INVOLVED

I started my research pioneering amorphous silicon for <u>solar cells and optoelectronics in 1976 with W. Spear and N. Mott</u>. I am the builder of the advanced functional materials for electronics and thin film solar cells activity in Portugal with impact worldwide, installing also the first clean room in Portugal. My research <u>MEON team at CENIMAT/I3N</u> deals with functional materials for electronics and energy applications, nanotechnologies and Micro/nano-electronics, based on hybrid systems, mainly centred in oxides and paper electronics, aiming to exploit their use in building electronics circuits and power sources on flexible bio-foils to promote a holistic perspective toward sustainability of low cost and fully disposable mobile integrated products that capture the needs associated with the Internet of Things. These systems will contribute to our future lifestyles at the level of communications, logistics, and medicine, being powered by solar energy, backup by supercapacitor, where no battery will be needed, turning systems' energy harvesting self-sustainable. Two of the most successful accomplishments of my group includes the first full oxide <u>TFT deposited @RT</u> and the <u>paper transistor</u>, with expected high impact in the global circular economy and industry of future. The graphic shows my most important landmarks in in the last 10 years. My background, skills and scientific trans-disciplinary achievements related to advanced functional materials, electronics and



physics, to build up creative devices and products to serve the needs of the industry mission of the future, clearly demonstrate that I have the ground-breaking capability to leader outstanding teams and to perform world-class research focused on adventures of the future and how they can serve the society. As a result, my lab acquired a world-class reputation for high performance electronic applications using unconventional materials & by promoting novel imaginative device architectures, as ground-breaking performers.

My group is constituted by about 60

members (12 permanent staff, 25 PhD students, 15 post docs, 6 technologists and several MSc students) and it is supported by the Portuguese Science and Technology Foundation (http://alfa.fct.mctes.pt/) through pluriannual contracts with CENIMAT/ I3N and a specific programmatic contract due to the fact that since 2006 we integrate the Associate Laboratory I3N (Institute of Nanostructures, Nanomodeling and Nanofabrication). Recently (2014) I3N was considered one of the 11 exceptional Research Laboratories out of more than 330 evaluated by FCT in all areas and the only one working in the field of Advanced Materials and Nanotechnologies with such ranking. Moreover, research towards applications is performed within CEMOP/Uninova that I am the founder and the head of research center.

Moreover, I regularly participate in or coordinate proposals submitted to National, European or International calls for projects or have direct contract with industry. In the last 20 years my group won 54 projects, under my coordination or as a partner,

generating 41,694,036.00 €, from which 38 are International. We apply in the same period for 66 patents, from which 43 were already conceived, revealing so the degree of our creativity and originality.

My main achievement as far conducting research and high level formation is concerned relies on having formed and having work with me 5 ERC awards: <u>Elvira Fortunato</u>, my PhD student and my co-worker, got an Advanced ERC Grant in Materials Science and Engineering (Advanced Amorphous Multicomponent Oxides for Transparent Electronics, Invisible, 2.25 M€) in the first edition (2008) as well as in 2018, with the amount of 3.5 M€; <u>I. Ferreira</u> my PhD student and my co-worker, got in 2015 a consolidator ERC grant in Materials Science and Engineering ("Integration of capacitor, thermoelectric and photovoltaic thin films for efficient energy conversion and storage"- CapTherPV., 2 M€); <u>Luis Pereira</u> a start ERC grant in Materials Science and Engineering "TREND - Transparent and flexible electronics with embedded energy harvesting based on oxide nanowire devices", 1.5 M€).

As far as students are concerned, I would highlight the supervision of the master thesis of the following students:

Miguel Sanches (Advanced Materials applications, 1994), CEO of Volkswagen group in Portugal, since 2016.

Solution Section 2015. <u>Gonçalo Andrade</u> (Microelectronics, 1996), the CEO of IBM in Portugal, since 2015.

As the *most recent landmarks*, we have the following key relevant achievements:

- a) The work on paper electronics is the editorial of Nature Electronics, 13 August 2018 (<u>https://www.nature.com/articles/s41928-018-0128-7</u>);
- Publishing the first scientific paper aiming to exploit, as proof of concept, paper transistor for multipurpose applications: R. Martins et al, in Papertronics: Multigate paper transistor for multifunction applications, Applied Materials Today 12 (2018) 402–414:
- c) August 2018, Administrator of the first start-up to exploit the paper electronics called NTPE Research, Development and Commercialization of Transistors, Electronics Biosensors, Paper based Lda; Investigação, Desenvolvimento e Comercialização de Transístores e Biosensores Electrónicos de Papel, Lda".
- d) In August 2018 the official launch of the Collaborative laboratory, Almascience, involving the pioneer labs of paper electronics with the paper industry and product end users, mainly connected to security and exploiting smart diagnostics platform commodities.
- e) In July 2018, the full recognition by the Academia that elected for the <u>International Physics Olympics, IPhO-2018</u> hold in Lisbon, July 2018, the paper transistor as the device to be tested in the experiments by more than 450 students worldwide. This was also the editorial of Nature journal of 13 August 2018.
- f) In June 2018, during the Innofest 2018 Innovation context idea competition to boost printing intelligence, organized by PrintoCent from VTT, a team of my young researchers from Uninova/ FCT-UNL won the first prize with the concept idea of Droplet Runners (see http://ouluhealth.fi/oulu-in-the-centre-of-boosting-printed-intelligencebusiness-at-innofest-2018/).
- g) The Spanish newspaper El Pais in the May 2018 edition highlight our activity in the area of paper electronics, as a key area of future development.
- h) To be nominated by the European Patent Officer as one of the Inventors of the year 2016 with the paper transistor work (http://www.epo.org/learning-events/european-inventor/finalists/2016/fortunato.ht).
- i) To establish the first Portuguese partnership with the Nature group, from which it results in the launch of the npj 2D Materials applications journal in 2016.
- j) Responsible by the activity that end up with the acceptance of FCT-UNL as a core partner of the Knowledge and Innovation Community (KIC) for Raw Materials of the European Institute of Technology, belonging to the Central Colocation Centre, Metz, France, since 2016.

As far **the involvement in projects are concerned**, we would like the highlight the following selected projects:

a) Project or Scientific coordinator:

- i. "Materials Synergy Integration for a Better Europe, BET-EU", H2020-TWINN-2015, CSA, proposal number: 692373, Coordinator: Uninova. Partners: University of Cambridge (UK); NOVA ID FCT (PT); -Teknologian tutkimuskeskus VTT Oy Finland (FL); Fraunhofer, IKTS (D); Sociedade Portuguesa de Investimentos, SPI (PT). Budget Campus FCT 405K€. Coordinator: R. Martins
- "Oxide Materials Towards a Matured Post-silicon Electronics Era, Orama", FP7-NMP-2009-Large-3, CP-IP 246334-2 7 2010. Coordinator (Fraunhofer-D).. Partners: Foundation for Research and Technology Hellas, Gr; Institut Jožef Stefan, SL: Philips Electronics UK LTD; Philips Electronics Nederland B.V.NK, NL; OSRAM Opto Semiconductors GmbH, DE; Consiglio Nazionale delle Ricerche, IT; Justus-Liebig-Universitaet Giessen, DE; University College London, UK; University of Cambridge, UK; Eberhard Karls Universitaet Tuebingen, DE; Steinbeis GmbH & Co. KG fuer Technologietransfer, DE; Nederlandse Organisatie voor Toegepast

Natuurwetenschappelijk Onderzoek – TNO, NL; Centro Ricerche Fiat SCPA, IT; Bekaert Advanced Coatings NV, B. Budget Campus FCT:1,115,000.00 €.

Co-coordinator and scientific coordinator: R. Martins

iii. "Smart electrochromic active matrix components for stand-alone multifunctional devices, SMART-EC". FP7-ICT-2009.3.9: Microsystems and smart miniaturized systems, grant nº 258203 Coordinator: CRF (IT); Research Responsible (CEMOP/CENIMAT, PT). Partners: Politecnico di Torino, IT; ACREO AB, SE; Rockwood Pigments Ltd, UK; Bundesdruckerei GmbH, DE; Commissariat à l'Energie Atomique et aux Energies Alternatives, for its LITEN laboratory, F; PLASTIQUES RG, F; Fraunhofer Gesellschaft zur Förderung der angewandten Forschung e. V., DE;SOLEMS SA, F; ViTechnology, F; G24 Innovations Ltd; UK; Bioage S.r.I., IT. Budget Campus FCT: 832,500.00 €.

Co-coordinator and scientific Responsible: R. Martins.

iv. "Autonomous Printed Paper products for functional Labels and Electronics, APPLE" FP7-NMP-2010-SME-4, Proposal No:262782-2 APPLE CP-TP. Coordinator: Centre Technique du Papier (F). Partners: Uninova/CEMOP/CENIMAT, PT; VTT (FI); Varta (DE); Commissariat à l'Energie Atomique, F; Nederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, NL; Polypore, F; ViTechnology (BI); RG Plastiques, F; Felix-Schoeller (DE); JoutsenPaino (FI); Reynders Etiketten Polska (PI). Budget to Campus FCT. Budget Campus FCT: 458,864.00 €

Scientific coordinator: R. Martins and E. Fortunato.

v. "Multicomponent Oxides for Flexible and Transparent Electronics-MULTIFLEXIOXIDES" FP6-2004-TI-4" – Proposal n° 032231 (2006/2009). Partners: Uninova (PT), Tyndall (IR); CENIMAT (PT); U. Barcelona (ES); HP (IR); FIAT (IT); J. Stefan Institute (SI). Budget Campus FCT: 566,000.00 €.
Coordinator: R. Martins. <u>This was the first EU Project exploiting oxides as functional materials and it was</u> considered in the top 10 of FP6.

b) Project partner:

- a) Scale-Up of Printed Electronics Recyclable SMART materials. Proposal number: 17161/2017 KIC Raw Materials. SUPERSMART Coordinator: Arkema, France. Partners: Arjowiggins, France, CEA, France, Coatema Coating Machinery GmbH, Germany (COA), FCTUNL, Portugal; Fraunhofer ISC, Germany; Joanneum Research, Austria; Luquet & Duranton, France, Université de Bordeaux, France, VTT Technical Research Centre of Finland Ltd, Finland (VTT) RTO. Budget Campus FCT: 338, 340.00€.
- b) 1D Nanofibre Electro-Optic Networks (1D-NEON), H2020-NMP-2015-IA, proposal number: 685758-2. Coordinator: Oxford University (UK). Partners: Uninova (PT); Un. Cambridge (UK); CeNTI (PT); FUNDACIO EURECAT (SP); Textilforschungsinstitut Thuiringen Vogtland e.V. (D); LG Display Germany GmbH (D); SAATI SPA(IT); Solvay Specialty Polymers (IT); SILVACO Europe Ltd (UK); BioAge (IT); RELATS S.A. (IT); HENKEL KGaA (D); PHILIPS ELECTRONICS NEDERLAND B.V. (NL). Budget Campus FCT: 987M€.
- c) Innovative Autonomous Electrical Biosensor synergistically assembled inside a passive direct methanol fuel cell for screening cancer biomarkers, SYMBIOTIC, H2020-FETOPEN-2014-2015-RIA, proposal number 665046. Coordinator: Instituto Superior de Engenharia do Porto; Imperial College of Science, Technology and Medicine (UK); UNINOVA (PT); VTT Technical Research Centre of Finland (FN); Aarhus Universitet (DN). Campus FCT budget: 527k€.
- d) Integrated flexible photonic sensor system for a large spectrum of applications: from health to security-i-FLEXIS. FP7-ICT-grant n° 611070: Alma Mater Studiorum -Università di Bologna, UNIBO, Italy; EURORAD, France; ELETTRA – Sincrotone Triest, SCPA, Italy; UNINOVA, Portugal; CEA, France; Nanograde AG, Switzerland; TAGSYS, France. Campus FCT budget: 475000 €.

10 MOST RELEVANT PUBLICATIONS IN THE LAST 10 YEARS

In the following we indicate the selected relevant papers covering the areas of my research, especially the ones dealing with processing, synthesis and applications of functional materials for electronics, energy and bio-detection, emphasizing their impact. Here we also include the book that it is a reference of our pioneer work in the field of transparent electronics.

- "Oxide Semiconductor Thin-Film Transistors: A Review of Recent Advances," E. Fortunato, P. Barquinha, and R. Martins, Advanced Materials, 24, 2945-2986, 2012 (citations: 1544; IF=21.95) [a key paper in the so-called transparent electronics, initiated in 2004 by the group].
- "Solution Combustion Synthesis: Low-Temperature Processing for p-Type Cu:NiO Thin Films for Transparent Electronics", A. Liu, HH Zhu, ZD Guo, Y. Meng, GX Liu, E. Fortunato, R. Martins, FK Shan, Advanced Materials, Vol. 29 (34), (2017), article: 1701599. (citations: 17; IF=21.95) [a recent key paper high relevant in the field of functional p-type oxides for electronics applications].
- 3. Transparent oxide electronics: from materials to devices, P Barquinha, **R Martins**, L Pereira, E Fortunato, John Wiley & Sons (book, 2012, cited 126) [a book that contains the main information on the activity performed in the field of oxides and paper electronics].

- "High-performance flexible hybrid field-effect transistors based on cellulose fiber paper", E Fortunato, N Correia, P Barquinha, L Pereira, G Gonçalves, R Martins, IEEE Electron Device Letters 29 (9), 988-990 (Citations: 210; IF=3.43). [The first published paper exploiting paper as a component for electronics and the basis of a patent].
- Complementary Metal Oxide Semiconductor Technology With and On Paper". R. Martins, A. Nathan, R. Barros, L. Pereira, P. Barquinha, N. Correia, R. Costa, A. Ahnood, I. Ferreira, E. Fortunato., Advanced Materials, 23 (2011), 4491–4496 (Citations: 144; IF=21.95). [The first CMOS device made on and with paper].
- 6. "Multifunctional cellulose-paper for light harvesting and smart sensing applications", António T Vicente, Andreia Araújo, Manuel J Mendes, Daniela Nunes, Maria J Oliveira, Olalla Sanchez-Sobrado, Marta P Ferreira, Hugo Águas, Elvira Fortunato, Rodrigo Martins, Journal of Materials Chemistry C 6 (13), (2018), pp. 3143-3181. [A review paper elected by the publisher as in the the top 10 of 2018].
- 7. "Passive radiofrequency x-ray dosimeter tag based on flexible radiation-sensitive oxide field-effect transistor" Tobias Cramer, Ilaria Fratelli, Pedro Barquinha, Ana Santa, Cristina Fernandes, Franck D'Annunzio, Christophe Loussert, Rodrigo Martins, Elvira Fortunato, Beatrice Fraboni, Sci. Adv. 4, 2018; eaat1825. [a innovative use of oxide TFT that lead to the submission of a patent].
- 8. "Papertronics: Multigate paper transistor for multifunction applications", **Rodrigo Martins**, Diana Gaspar, Manuel J. Mendes, Luis Pereira, Jorge Martins, Pydi Bahubalindruni, Pedro Barquinha, Elvira Fortunato, Applied Materials Today 12, (2018) pp. 402-414 [*Exploiting the use of multifunctional devices to decease the degree of device complexity integration, moving from device integration to functions' integration*].
- "A low cost, safe, disposable, rapid and self-sustainable paper-based platform for diagnostic testing: lab-on-paper", M. N. Costa, B. Veigas, J. M. Jacob, D. S. Santos, J. Gomes, P. V. Baptista, R. Martins, J. Inácio and E. Fortunato, Nanotechnology 25 (2014) art nº 094006 (12pp). DOI: 10.1088/0957-4484/25/9/094006. (Citations: 107; IF: 3.404).
 [a key paper of the group, exploiting paper for bio detection].
- "Electro-Typing" on a Carbon-Nanoparticles-Filled Polymeric Film using Conducting Atomic Force Microscopy", S. Goswami, S. Nandy, A.N. Banerjee, A. Kiazadeh, G.R. J.V. Pinto, S.W. Joo, **R. Martins,** E. Fortunato, Advanced Materials, Vol. 29 (47) (2017), article nº 1703079. DOI: 10.1002/adma.201703079. (Citations: 14; IF: 21.95). [involving simultaneously nanomaterials and exploiting a characterization tool].
- "Thin film silicon photovoltaic cells on paper for flexible indoor applications", Hugo Águas, Tiago Mateus, António Vicente, Diana Gaspar, Manuel J. Mendes, Wolfgang A. Schmidt, Luís Pereira, Elvira Fortunato, and Rodrigo Martins, Advanced Functional Materials, 25 (23) (2015), pp. 3592-3598 (citations:44; IF=13.325). [First published paper exploiting paper as a substrate of inorganic based solar cells].

SELECTED 5 GRANTED PATENTS (out of 43 granted and 16 pending)

In the last 8 years were conceived 43 international granted patents and trademarks, in the fields of: paper electronics; paper memories; bio detection platforms; n and p-type oxides for n and p type device processing, CMOS full oxide based; Electrochromic transistors; Multiband gap-based dielectrics for device processing; Mesoscopic Optoelectronic devices; 16 pending patents in the same fields above mentioned plus lonization sensitive field effect device and manufacturing method. Below we mention the 5 most relevant patent issued.

1. E. Fortunato, R. Martins, Use of cellulose and bio-organic based paper simultaneously as physical support and /dielectric component in field effect electronic and optoelectronic based devices". Owner: FCT-UNL", Portugal PAT 40050/09;Mexico, PTI-MX 42405/10; Russia PTI-RU 42410/10; Japan, PTI-JP 42413/10; Australia, PTI-AU 42415/10.

2. E. Fortunato, R. Martins, L. Pereira, P. Barquinha & N. Correia, Process of Creation and use of paper based on natural cellulosic fibers, synthetic fibers or mixed fibers as physical support and storing medium for electrical and ionic charges in self-sustaining field effect transistors with memory using active semiconductor oxides. Owner: FCT-UNL. PT, PAT 40051/09; Mexico PTI-MX 42418/10; Russia, PTI-RU 42422/10; Jp, PTI-JP 42425/10; Australia, PTI-AU 42427/10.

3. R. Martins E. Fortunato, P. Baptista, "Detection and quantification system of biological matter constituted by one or more optical sensors and one or more light sources, associated process and respective uses. Owner: FCT-UNL.

Spain PTE-ES 43934/11; UK PTE-GB 43935/11; France, PTE-FR 43936/11; Germany PTE-DE 43937/11; Ireland, PTE-IE 43938/11; Portugal PTE 43949/11; USA PTI-US 40003/09; South Africa PTI-ZA 40004/09.

4. R. Martins and E. Fortunato, "Electronic Semiconductor devices based on copper nickel and Gallium-Tin-Zinc-Copper-Titanium p and n-type oxides, their applications and corresponding fabrication manufacturing Processes. Owner: FCT-UNL. Austrália, PTI-AU 40653/09; Canada, PTI-CA 40654/09; USA, PTI-US 40656/09.

5. R. Martins, E. Fortunato, "Electrochromic Thin Film Transistors with lateral or vertical structure using functionalized or non-functionalized substrates and method of manufacturing the same". Owner: FCT-UNL. South Africa, PTI-ZA 44507/11; USA, PTI-US 46369/12; Brazil, PTI-BR 46370/12.

SELECTED 10 PLENARY TALKS GIVEN IN THE PAST 5 YEARS, OUT OF 100

1. Rodrigo Martins, Luís Pereira and Elvira Fortunato, Paper Electronics and The Sustainable Cities of the Future, 10th edition of the electronic IDentity conference, <u>elD conference</u>, 27th and 28th September 2018, Lisbon, Portugal @ Fundação Champalimaud.

- 2. Rodrigo Martins and Elvira Fortunato, Driving Flexible Electronics by Hybrid Materials, <u>21st International Conference on</u> <u>Advanced Materials and Nanotechnology</u>, Zurich, Switzerland, 04-06 September 2018.
- 3. R. Martins, L. Pereira, E. Fortunato, Multifunctional paper electronics, <u>6th Dresden Nanoanalysis Symposium</u>, Dresden, Germany, August 31, 2018.
- 3. Rodrigo Martins, M. Mendes and E. Fortunato, Materials: The Crosscutting Component for the Missions of the Future, Advanced Materials Forum, Hangzhou, China, 25-26 May 2018.
- Rodrigo Martins, L. Pereira, E. Fortunato, Flexible Green Electronics for Smart Applications, <u>International Conference</u> on <u>Advanced Nanomaterials and Nanotechnology, ICANN-2017, December 18-21, 2017</u>, ICANN-2017, organized by the Centre for Nanotechnology at the Indian Institute of Technology Guwahati (IITG), India, Calcutá, India.
- 5. Rodrigo Martins, <u>The role of Materials Science in the Missions of the Future, Industrial Innovation Info Days</u>, Organized by European Commission 3-4 October 2017 Brussels, Belgium.
- 6. Rodrigo Martins, A. Vicente, M. Mendes, E. Fortunato, A <u>statistics modelling approach for the optimization of thin film</u> <u>photovoltaic devices</u>, 7th International Symposium on Energy, Manchester, England, 13-17 August 2017.
- R. Martins, E. Fortunato, Sustainable materials applied to flexible electronics: the case of cellulose, <u>SESSION 2</u>: <u>Nanotechnologies Applications for Electronics, EuroNanoForum 2017, EU Malta presidency, La Valletta, 21-23 June</u> <u>2017.</u>
- 8. R. Martins, E. Fortunato, <u>Multifunctional metal oxides on the front edge of new societal challenges, TO-BE 2016 Spring</u> <u>Meeting, University of Warwick, England, 6-8 April 2016.</u>
- 9. R. Martins, L. Pereira, E. Fortunato, Smart Green Electronics with and on Paper, IUMRS-ICAM2013, Qingdao, China.
- 10. Paper Electronics: a challenge for the future, Society for Information Display (SID 2013), Vancouver, Canada, 22-May.

RECOGNISED LEADERSHIP AND EXPERT OPINION

Coordinator of 1st <u>EU project involving HP</u> dealing with full devices oxide based and considered on top 10 of all projects taken under FP6 EU programme; scientific coordinator of 2 IP projects dealing with oxides (<u>ORAMA</u>) and electrochromics (<u>SMART-EC</u>) involving more than 17 enterprises; invited by <u>USA/NSF Papertronics workshop</u>, where the strategy of future in this field was discussed for USA. Industries recognises our innovation leadership in the fields of transparent and flexible electronics and paper electronics; working as adviser of Merck for preparation of solution based inks for TFT printing; invited by the <u>Imprensa Nacional</u>, <u>Casa da Moeda</u> as adviser for application of paper electronic concept to security matters as passports. From all we would like to point out SAMSUNG, MERCK, LG, SAINT GOBAIN, and the paper industries, <u>SUZANO</u>, <u>PORTUCEL</u>, <u>STORA ENSO</u>; <u>Felix Schoeller</u>. We have common patents with Samsung and LG in the area of oxides TFT and memories. As expert, I signed the <u>Arhus declaration at the Industrial Technologies 2012</u>, a landmark for European Commission; promoter of the <u>Materials Common House concept approved by EC</u>; member of the EU working group that wrote: "<u>Strategy and Road mapping for Industrial Technologies to Address Grant Challenges</u>"; <u>Nanofutures platform</u>, integrating the panel "Inventive session on nano-micro manufacturing"; EU Materials Roadmap working group.