

Fabrice PIAZZA, Ph.D.

Director of the Nanoscience Research Laboratory
Leader of the Functional Nanostructured Carbon Materials Research Group - *NANOCARBON*

Vice Rector's Office for Research and Innovation - VII
Pontificia Universidad Católica Madre y Maestra- PUCMM

Santiago, Dominican Republic
Off.: +1 809 580 1962, ext. 4081

Email: fpiazza@pucmm.edu.do; fpiazza75@gmail.com

Physicist - Specialized in Nanostructured Carbon Materials Applied Research

EDUCATION

1998-2001 : Ph.D. in Physics, University Louis Pasteur (ULP), Strasbourg, France.

1998 : Post-graduate degree in Nuclear and Subatomic Particles Physics, ULP.

1997 : Master's Degree in Physics, University Henri Poincaré (UHP), Nancy, France.

PROFESSIONAL EXPERIENCE

From Ag. 2006: **Professor and Researcher**, Vice Rector's Office for Research and Innovation
PONTIFICIA UNIVERSIDAD CATOLICA MADRE Y MAESTRA (PUCMM), Santiago, Dominican Republic.

Associate Professor since June 2012.

Director of the Nanoscience Research Laboratory (NRL) since November 2010.

Leader of the Functional Nanostructured Carbon Materials Research Group (NANOCARBON) which he founded in 2007.

Visiting Scientist, Centre d'Elaboration de Materiaux et d'Etudes Structurales (CEMES), National Center for Scientific Research (CNRS), Toulouse, France (October 2015).

A. Research:

- Proposed the development of nano-science and technology research in PUCMM.
- Have helped at the definition of PUCMM research policies and practices.
- Have directed the research on promising nanostructured materials, such as nanocrystalline diamond thin films, diamond nanowires, carbon nanotubes, graphene, hybrid materials, BN nanostructures, nanostructured diamond-like carbon, for electronics, energy, environment, medicine, thin film coatings, smart, strong and light-weight structural materials.
- Have contributed to the research education of 17 students (Graduate student: 1; undergraduate students: 16).
- Have succeeded in equipping the NRL with fundamental and strategic scientific instruments:
 - two material synthesis systems for US \$ 211 k (HFCV and CVD systems),
 - one multi-wavelength micro-Raman spectrometer for US \$ 305 k.
 - a scanning probe microscope of lateral atomic resolution including scanning tunneling microscopy mode for US \$ 243 k.
- Have developed and initiated fruitful international collaborations (University of Puerto Rico, Rochester Institute of Technology, CEMES-CNRS).

Grant History (as P.I. o co-P.I.):

1. *New method to store hydrogen in graphene materials*,
\$ RD 14,289,301.55 (3 years), Ministry of Higher Education, Science and Technology of the Dominican Republic (MESCYT, previously known as SEESCYT), 2015 FONDOCYT program.

2. *Diamond nanowire arrays from bottom-up method;*
\$ RD 11,998,201.39 (4 years), 2012 MESCYT, FONDOCYT program.
3. *New technology for nanocrystalline diamond thin film synthesis;*
\$ RD 10,977,919.74 (4 years), 2010-2011 MESCYT FONDOCYT program.
4. *Carbon nanotubes membranes for water nanofiltration and desalinization;*
\$ US 264,705 (3 years), 2008 SEESCYT FONDOCYT program.
5. *Nanocrystalline Diamond thin films at low substrate temperature II;*
\$ US 264,705 (3 years), 2008 SEESCYT FONDOCYT program.
6. *Nanocrystalline Diamond thin films at low substrate temperature I;*
\$ US 146,857 (3 years), 2007 SEESCYT FONDOCYT program.
6. *Remodeling of a Nanoscience research laboratory;*
\$ US 43,243 PUCMM, 2009.
7. *Nanocrystalline Diamond thin films at low substrate temperature;*
\$ US 2,000, PUCMM; 2007-2008 Grants for Research.

Research results obtained:

- Found a new method to store hydrogen in graphene materials.
- Found a new method to grow nanocrystalline diamond (NCD) films below 200°C substrate temperature at high growth rate (above 3 μm/h).
- Found a new method to coat carbon nanotubes with diamond nanocrystals and SiC with high conformal degree below 200°C (International, U.S. and Taiwanese patent applications pending).
- Found a new method to grow SiC / NCD nanocomposites below 200°C substrate temperature.
- Experimentally confirmed the synthesis of diamond nanocrystals on polymer substrates at low substrate temperature.
- Comprehensively studied the wettability and surface energy of nanostructured diamond-like carbon films.
- Comprehensively investigated the surface topography and growth mechanisms of nanostructured diamond-like carbon films deposited by distributed electron cyclotron resonance plasma.
- Studied the aseptic property of nanostructured diamond-like carbon surfaces for medical applications.
- Contributed to the achievement of high-yield synthesis of BN nanostructured to strengthen light structural materials.

B. Teaching:

Earned PUCMM University Diploma in Pedagogy, December 2008.

Teaching to Engineering Students:

- *Introduction to Nanotechnology, Classical Electromagnetism, General Physics 1 and 2.*
- Have proposed, designed and taught a course on *Introduction to Nanotechnology.*
- Have designed a course on *Nanostructured Carbon Materials.*

Teaching to Professors:

- *Research Proposal Writing.*
- *Research Paper Writing.*

C. Committees

- PUCMM Postgraduate Research Committee Member (February 2011).
- PUCMM Research and Innovation Council Member since January 2012.
- Research and Community Relations Committee Member for 2016-2021 PUCMM Strategic Plan (June 2015-April 2016).
- PUCMM Department of Basic Sciences Recruiting Committee Member (since July 2016).

2004-2006: Research Associate, Department of Physics, **UNIVERSITY OF PUERTO RICO (UPR)**, San Juan, Puerto Rico.

- Carried out top-notch research on diamond, and nanotubes targeting emerging technologies, and novel systems concepts with high potential payoff.
- Succeeded in elaborating diamond nanocrystals on polymer at sub. 300 °C substrate temperature for microelectronics and thin film coating applications.
- Succeeded in elaborating BCN nanotubes for space applications (microelectronics, strong and light-weight materials).
- Worked on nanocrystalline diamond bio-nanoprobes for in vivo cellular imaging.
- Supported students working on different research projects.
- Participated in the elaboration of research grant proposals (NSF, DoD, DoE, NASA).

2001-2004: Research Associate, Department of Engineering, **UNIVERSITY OF CAMBRIDGE**, Cambridge, England.

- Conducted the research, and succeeded in providing innovative protective carbon coatings by electron cyclotron wave resonance plasma for next generation of ultra-high storage density CDs and DVDs (European project *FAMOUS*: Project IST-2000-28661).
- Collaborated with various European companies such as Philips and Thomson.
- Successfully coordinated the work of researchers, students, and technicians.
- Initiated or developed fruitful collaborations.
- Oversaw the use of process and characterization techniques; trained and supported students.

1998-2001: PhD Student, **NATIONAL SCIENTIFIC RESEARCH CENTER (CNRS)**, Strasbourg, France.

- Research on multifunction, nanostructured diamond-like carbon thin films (DLC) from distributed electron cyclotron resonance (DECR) plasma deposition (European project BRPR980749 *DIAMCO*, FP4-BRITE/EURAM 3).
- Collaborated with various European companies such as Radstone Technology, Roth & Rau and Intercast Europe.
- Successfully designed and developed routes for the synthesis of DLC over large area by a pre-industrial prototype of a DECR plasma reactor.
- Established unambiguous relationships between the processing and physical parameters, nucleation and growth mechanisms, composition, structure and physical properties of the DLC coatings.
- Found solutions for technological issues, such as decrease in contamination and increase in homogeneity of large area coatings, plasma immersion of polycarbonate in DECR reactor (control of the ion bombardment), adhesion of stress films on different substrates, polarization of complex geometry polycarbonate substrates.
- Provided successful demonstrators to industrial partners such as:
 - DLC coated plastic optical components to be used in sunglasses, helmet visors, and bar code scanners. These demonstrated superior scratch resistance, decorative added value and excellent stability and durability.
 - DLC coated microelectronic assemblies showing higher moisture resistance and reliability.
- Developed an optical technique to measure the curvature of thin films containing stress.
- Initiated or developed fruitful collaborations.
- Installed and evaluated new reactors.
- Optimized processes and improved reactor design.

MAIN SKILLS

- **Materials, physics and chemistry of plasma processes, interaction ions-matter, thin film deposition and vacuum science, nanotechnology.**
- **Plasma:** CVD, PECVD and PVD processes; diagnostic; surface treatment.
- **Thin film characterization techniques:** nuclear techniques (NRA, RBS, ERDA); optical spectroscopy (Raman, FTIR, UV-VIS-NIR), electron energy loss spectroscopy, optical and electron microscopy (SEM, TEM), atomic force microscopy (AFM); X-ray diffraction; electric measurements, contact angle measurements.
- **Managing research projects and laboratory.**

LANGUAGES

French:	Native speaker.
English:	Fluent (writing, speaking).
Spanish:	Fluent (writing, speaking).

PATENT, SCIENTIFIC PUBLICATIONS /CONFERENCES, BOOK CHAPTER

- **Patent:** *Method for making an extreme UV microlithography transmission modulator and resulting modulator*, French patent O/MD/BFF 00-0012.
- **Patent Applications:** *Carbon Nanotubes Conformally Coated With Diamond Nanocrystals or Silicon Carbide, Methods of Making the Same and Their Use* (U.S. Utility Patent Application No. 14/079,546; International Patent Application No. PCT/US2013/069934; Taiwanese Patent Application No. 102141512).
- **Publications:** 32 publications in peer review international journals, including:
 1. *Carbon Nanotubes Coated with Diamond Nanocrystals and Silicon Carbide by Hot-filament Chemical Vapor Deposition below 200 °C*, F. Piazza, G. Morell, J. Beltran-Huarac, G. Paredes, M. Ahmadi, M. Guinel, **Carbon**, accepted (DOI: 10.1016/j.carbon.2014.03.43).
 2. *High Growth Rate Synthesis of Diamond Films on Plastic Substrates and Freestanding Diamond Films below 360 °C Substrate Temperature*, F. Piazza¹, J. Beltran-Huarac, G. Paredes, G. Morell, **Diamond and Related Materials**, submitted.
 3. *Synthesis of diamond nanocrystals on polyimide film*, F. Piazza, F. Solá, O. Resto, L.F. Fonseca, G. Morell, **Diamond and Related Materials**, 18, 113 (2009).
 4. *Wettability of Hydrogenated Tetrahedral Amorphous Carbon*, F. Piazza, G. Morell, **Diamond and Related Materials**, 18, 43 (2009).
 5. *High-Yield Synthesis of Stoichiometric Boron Nitride Nanostructures*, J.E. Nocua, F. Piazza, B. Weiner, G. Morell, **Journal of Nanomaterials**, Volume 2009, Article ID 429360.
 6. *Synthesis of diamond at sub 300 °C substrate temperature*, F. Piazza, G. Morell, **Diamond and Related Materials**, 16, 1950 (2007).
 7. *Non-linear effects in collision cascades and high-energy shock waves during ta-C:H growth*, F. Piazza, O. Resto, G. Morell, **Journal of Applied Physics**, 102, 013301 (2007).
 8. *Hard-hydrogenated tetrahedral amorphous carbon films by distributed electron cyclotron resonance plasma*, F. Piazza, **International Journal of Refractory Metals and Hard Materials**, 24, 39 (2006).
 9. *Formation of boron carbonitride nanotubes from in situ grown carbon nanotubes*, F. Piazza, J.E. Nocua, A. Hidalgo, J. De Jesus, R. Velazquez, B.L. Weiss, G. Morell, **Diamond and Related Materials**, 14, 965 (2005).
 10. *Diamond film synthesis at low temperature*, F. Piazza, J.A. González, R. Velázquez, J. De Jesús, S.A. Rosario, G. Morell, **Diamond and Related Materials** 15, 109 (2006).
 11. *Protective diamond-like carbon coatings for future optical storage disks*, F. Piazza, D. Grambole, D. Schneider, C. Casiraghi, A.C. Ferrari, J. Robertson, **Diamond and Related Materials**, 14, 994 (2005).

12. *Large area deposition of hydrogenated amorphous carbon films for optical storage disks*, F. Piazza, D. Grambole, L. Zhou, F. Talke, C. Casiraghi, A. C. Ferrari, J. Robertson, **Diamond and Related Materials**, 13, 1505 (2004).
13. *Transpolyacetylene chains in hydrogenated amorphous carbon films free of nanocrystalline diamond*, F. Piazza, A. Golanski, S.Schulze, G. Relihan, **Applied Physics Letters**, 82, 358 (2003).
14. *Numerical study of the electrostatic field gradients present in various planar emitter field emission configurations relevant to experimental research*, A. González-Berríos, F. Piazza, G. Morell, **Journal of Vacuum Science and Technology B** 23(2) 645, Mar/Apr 2005.
15. *Bonding in hydrogenated diamond-like carbon by Raman spectroscopy*, C. Casiraghi, F. Piazza, A.C. Ferrari, D. Grambole, J. Robertson, **Diamond and Related Materials**, 14, 1098 (2005).
16. *Synthesis of unstrained failure-resistant nanocrystalline diamond films*, E.A. Mujica, F. Piazza, J. De Jesús, B.R. Weiner, S.D. Wolter, G. Morell, **Thin Solid Films**, 515, 7906 (2007).
17. *Effects of a nanocomposite carbon buffer layer on the field emission properties of multiwall carbon nanotubes and nanofibers grown by hot filament chemical vapor deposition*, K. Uppireddi, A. González-Berríos, F. Piazza, B.R. Weiner, G. Morell, **Journal of Vacuum Science and Technology B** 24 (2), 639 (2006).
18. *Hypersonic shock waves and hybridization of a-C:H thin film*, A. Golanski, J.P.Stoquert, F.Piazza, P. Kern, E. Laemmer, A. Deruyver, F.S. Schulze, L. McDonnell, **Journal of Applied Physics** 93, 5911 (2003).
19. *Effects of the intrinsic and external stress fields on the microstructure and physical properties of plasma deposited a-C:H thin films*, A. Golanski, F. Piazza, J. Werckmann, G. Relihan, S. Schulze, **Journal of Applied Physics**, 92, 3662 (2002).

▪ **Presentations:** more than 50 presentations at international conferences such as:

1st Caribbean Conference on Functional Materials (CARIBMAT 2016), Santo Domingo (**one invited talk**).

6th International New Diamond and Nano Carbons Conference (NDNC 2012), San Juan, Puerto Rico;

2nd Conference on New Diamond & Nano Carbons (NDNC 2008), Taipei, Taiwan;

2005 and 2006 International Conference on Applications of Diamond and Related Materials; USA; 2001, 2005 and 2006 Material Research Society Spring Meetings, San Francisco, USA.

2004 and 2005 Material Research Society Fall Meeting, Boston, USA.

2005 International Conference on Surfaces, Coatings and Nanostructured Materials, Aveiro, Portugal;

2004 International Conference on the Science of Hard Materials, San Juan, Puerto Rico.

2014, 2005, 2004, 2003, and 2002 International Conference of Diamond and Carbon Materials Conferences, Europe;

2002 International Conference on Ion Beam Modification of Materials, Kobe, Japan.

2000 European Material Research Society Spring Meeting, Strasbourg.

- **Book Chapter:** *Nanoscience and Nanotechnology in the Dominican Republic* (in Spanish) in Perspective on nanotechnologies development in Latin American (In Spanish), Foladori, G; Záyago, E. & Invernizzi, N. (Coord.). (2011). México D.F: Miguel Ángel Porrúa / ReLANS.

REVIEW / ORGANIZING COMMITTEES / MEMBERSHIP

▪ **Reviews:**

Have reviewed submitted papers for publication in international journals such as: Carbon, Nanoscale Research Letters, Physica Status Solidi, Diamond and Related Materials, Journal of Applied Physics, Journal of Material Research, Surface and Coating Technology, and Applied Surface Science.

Reviewed submitted proposals for funding through 2009, 2010-2011, 2012 and 2013 FONDOCYT Programs, Ministry of Higher Education, Science and Technology of the Dominican Republic.

▪ **Organizing Committees:**

Member of the Scientific Committee of the 1st Caribbean Conference on Functional Materials, Santo Domingo, November 2016.

Member of the Organizing Committee of Symposio 1B of the XXI International Materials Research Congress, Cancun, August 2012.

Member of the Organizing Committee of the Interdisciplinary Scientific Research Congress, Santo Domingo, Dominican Republic, since 2009.

▪ **Membership:**

Member of the Materials Research Society (MRS).

OUTREACH ACTIVITIES

- Science and research conferences, interviews and papers in various media: Internet, TV, newspapers, magazines, national scientific congress, science, technology and book fairs, etc.
- Research laboratory guided tour offered to kids, students, professors and industrials.
- Research group website.

AWARDS

Recipient of 6 Research Funding Program awards as PI or co-PI, from the Ministry of Higher Education, Science, and Technology of the Dominican Republic; 2007 (1), 2008 (2), 2010-2011 (1), 2012 (1) and 2015 (1).

Recipient of 2 research Funding Program awards from Pontificia Universidad Católica Madre y Maestra; 2007 (1) and 2009 (1).

REFERENCES

Prof. Dr. Gerardo Morell
University of Puerto Rico
Department of Physics
PUERTO RICO – USA
Phone : +1-787-763-6108
gmorell@gmail.com

Prof. Dr. John Robertson
University of Cambridge
Department of Engineering
ENGLAND
+44-1223-48331
jr214@hermes.cam.ac.uk

Prof. André Golanski (retired)
CNRS - Strasbourg
InESS Laboratory
FRANCE
+48-18-201-4201
andrzej466@wp.pl

Prof. Sarah González (former PUCMM Vice Rector for Research and Innovation, 2006-2015)
Pontificia Universidad Católica Madre y Maestra
Department of Basic Sciences
DOMINICAN REPUBLIC
Phone: + 1 809 580 1962 ext. 4350
sarahgonzalez@pucmm.edu.do