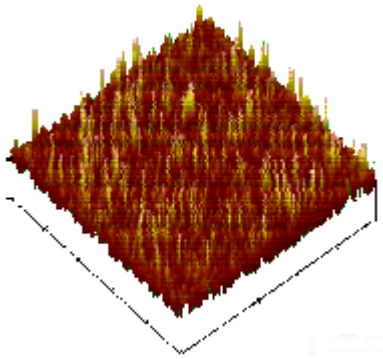
Carlos R. Cabrera

Nanotechnologist

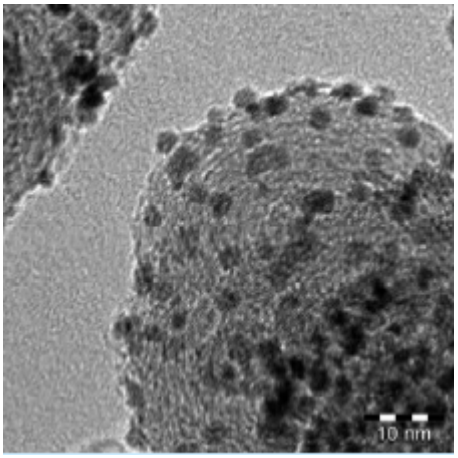
Biography

Cabrera is a Professor at the Department of Chemistry of the University of Puerto Rico, Río Piedras Campus. Cabrera's main research area is on the development of nanocatalysts for clean energy technology such as Fuel Cell Systems. This energy system is of importance for the development of environmentally friendly energy conversion and storage based on alcohols. Fuel Cells are becoming a promising clean energy system for vehicles, portable devices, and power generators. This area of research is part of the Institute for Functional Nanomaterials (IFN). Through the institute, Cabrera will develop catalytic nanomaterials for fuel cell testbeds and prototypes that will be evaluated at the NASA Glenn Research Center in Cleveland, Ohio. The creation of the IFN is creating a unique opportunity for the further development of Cabrera's nanotechnology research since new state-of-the-art instrumentations and unique partnerships with Nanotechnology Centers will be established. These centers are located at Purdue University, University of Massachusetts, Northwestern University, Cornell University and the Argonne National Laboratory.

Cabrera, from Naranjito, Puerto Rico, is a product of the public educational system. In 1982 he obtained a B.Sc. in Chemistry at the University of Puerto Rico, Río Piedras Campus and continued towards a Ph.D. in Chemistry at Cornell University and a Postdoctoral Research Associate position at the University of Texas at Austin. In 1989, Cabrera joined the University of Puerto Rico, Río Piedras Campus as an Assistant Professor. In the last 18 years, his energy and nanotechnology related research has been done with undergraduate and graduate students and postdoctoral research associates. In 2000, Cabrera worked at the NASA Glenn Research Center in the Electrochemistry with Fuel Cells and Li Battery Systems. Currently, he is the Director of the Center for Nanoscale Materials, which is sponsored by NASA. Through the years, the Department of Energy, Department of Defense, NASA, and the National Science Foundation have funded his research.



Atomic form microscopy (AFM) image of carbon nanotubes chemically attached to platinum electrodes surfaces for Fuel Cell Applications.



Transmission electron microscopy (TEM) of PtRu nanocatalyst prepared in Cabrera's research laboratory. The nanoparticles (black dots) are in the 5 nanometer (5 x 10^$^{-9}$ meter) in diameter size.

Teams

Cluster II: Functional Nanostructures at the Interface

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Education

- Ph.D. in Chemistry, Cornell University

Publications

1. C. R. Cabrera, E. J. Contes, M. Lebrón, M. Meador, and B. I. Rosario-Castro, ""Combined electron microscopy and spectroscopy characterization of as-received, acid purified, and oxidized HiPCO single-wall carbon nanotubes", Materials Characterization, (2009)
2. C. R. Cabrera, Y. Ishikawa, and R. Kinch, "A Density-functional Theory Study of the Water-gas Shift Mechanism on Pt/Ceria (111)", J. of Physical Chemistry C, (2009)
3. C. R. Cabrera, M. Flynn, I. Gonzalez-Gonzalez, K. H. Griebenow, and E. Nicolau, "Bioelectrochemical Degradation of Urea at Platinized Boron Doped Diamond Electrodes for Bioregenerative Systems", Advance in Space Research, (2009)
4. C. R. Cabrera, G. Sanchez-Pomales, L. Santiago-Rodriguez, and N. M. Vargas-Barbosa, "Biosensing Based on Single Stranded Deoxyribonucleotide Acid-Carbon Nanotubes Covalently Attached on Gold Electrodes", J. Nanoscience and Nanotechnology, 9, 2450 (2009)
5. C. R. Cabrera, G. Sanchez-Pomales, and L. Santiago-Rodriguez, "DNA-Functionalized Carbon Nanotubes for Biosensing Applications", J. Nanoscience and Nanotechnology, 9, 2175 (2009)
6. C. R. Cabrera, L. Santiago-Rodríguez, and G. Sánchez-Pomales, "Electrochemical DNA Sensing at Single-Walled Carbon Nanotubes Chemically Assembled on Gold Surfaces", Bioelectrochemistry, (2009)
7. C. R. Cabrera, L. La Torre-Riveros, H. Scibioh, and K. Soto, "Electrophoretically Fabricated Diamond Nanoparticle-Based Electrodes", Journal of the Electrochemical Society , (2009)
8. H. A. Abruña, C. R. Cabrera, E. R. Fachini, I. González-González, M. Scibioh, M. Tague, and D. A. Tryk, "Facet-Selective Platinum Electrodeposition at Freestanding Polycrystalline Boron-doped Diamond Films", Langmuir, (2009)
9. C. R. Cabrera, I. Gonzalez-Gonzalez, G. Morell, D. A. Tryk, and B. R. Weiner, "Modulation of electron transfer activity at diamond films by dissolved oxygen in aqueous solution", Journal of the Electrochemical Society , (2009)
10. L. Arroyo-Ramirez, C. R. Cabrera, R. Montano-Serrano, and R. G. Raptis, "Nanostructural Formation of Pd-Co Bimetallic Complex on HOPG Surfaces: A XPS and AFM Study", Research Letters in Nanotechnology, (2009)
11. C. R. Cabrera, M. Cabán-Acevedo, I. Feliciano-Ramos, and M. Scibioh, "Self-Assembled Monolayer of L-Cysteine on Palladium: An Electrochemical and Surface Analysis Study", Journal of Electroanalytical Chemistry, (2009)
12. C. R. Cabrera, G. Sanchez-Pomales, and L. Santiago-Rodriguez, "Single-Walled Carbon Nanotubes Modified Gold Electrodes as Templates for Impedimetric DNA Sensing", Bioelectrochemistry, (2009)

13. A. Arvia, C. R. Cabrera, E. Fachini, and F. Rodríguez-Nieto, "X-ray photoelectron spectroscopy of oxygen-containing layers formed by a linear potential scan on stepped gold (111) films in aqueous 1 M sulphuric acid", Thin Solid Films, 517, 1534 (2009)
14. C. R. Cabrera, R. M. Georgiadis, and J. Rivera-Gandía, "In-situ fluorescence spectroscopy of self-assembled monlayers of HS-(CH2)n-fluorescein and HS-(CH2)6-poly(dT)18-fluorescein at gold electrodes under cyclic voltammetric conditions", Journal of Electroanalytical Chemistry, 621, 75 (2008)
15. R. Brito-Gómez, C. R. Cabrera, J. Castillo-Ramirez, T. L. Diaz-Ortiz, M. Malave-Leon, M. Rivera-Claudio, and R. J. Tremont, "Modification of Au surfaces using new ferrocene derivatives", Applied Surface Science, 254, 1587 (2008)
16. C. R. Cabrera, Y. Ishikawa, and T. Morante-Catacora, "Sequential electrodeposition of Mo at Pt and PtRu methanol oxidation catalyst particles on", Journal of Electroanalytical Chemistry, 621, 103 (2008)
17. C. R. Cabrera, Y. Ishikawa, and T. Y. MORANTE-CATACORA, "Sequential electrodeposition of Mo at Pt and PtRu methanol oxidation catalyst particles on HOPG surfaces", JOURNAL OF ELECTROANALYTICAL CHEMISTRY, 621, 103 (2008)
18. C. R. Cabrera, Y. Ishikawa, J. J. Mateo, and D. A. Tryk, "Underpotential deposition of hydrogen on Pt(111): A combined direct molecular", Molecular Simulation, 34, 1065 (2008)
19. C. R. Cabrera, Y. Ishikawa, J. J. Mateo, and D. A. Tryk , "Underpotential deposition of hydrogen on Pt(111): a combined direct molecular dynamics/density functional theory study", MOLECULAR SIMULATION, 34, 1065 (2008)

Grants

1. C. R. Cabrera and M. J. Guinel. Novel electrochemical synthesis and advanced electron microscopy characterization of high performance fuel cell Pt-Co and Pt-Ru nanoelectrocatalysts on high surface area carbon supports, National Science Foundation, Chemistry, 3 years, October 2009, Multiple PIs, Pending, $350,000.
2. C. R. Cabrera. NOVEL ELECTROCHEMICAL SYNTHESIS AND ADVANCED ELECTRON MICROSCOPY CHARACTERIZATION OF HIGH PERFORMANCE FUEL CELL Pt-Co AND Pt-Ru NANOELECTROCATALYSTS ON HIGH SURFACE AREA CARBON, National Science Foundation, Sustainable Energy, 3 years, October 2009, Multiple PIs, Pending, $349,979.
3. O. Auciello, C. R. Cabrera, M. J. Guinel, Y. Ishikawa, J. Jellinek, M. Jose-Yacamán, G. Morell, R. G. Raptis, and G. Sandi. FUNDAMENTAL SCIENCE OF NANOSTRUCTURED ELECTROCATALYSTS/ DIAMOND SUPPORTS FOR FUEL CELL APPLICATIONS, United States Department of Energy, Hydrogen, 3 years, October 2009, Single PI, Pending, $3,900,000.
4. C. R. Cabrera, L. F. Fonseca, R. Furlan, G. Morell, L. G. Rosa, N. Sepúlveda, and J. Vedrine. MRI: Acquisition of an Atomic Force Microscope Nanolithography DPN 5000 System, National Science Foundation, DMR - MRI, 1 year, August 2009, Multiple PIs, Pending, $386,736.

5. F. M. Aliev, C. R. Cabrera, L. F. Fonseca, K. H. Griebenow, A. J. Hernández, Y. Ishikawa, R. S. Katiyar, M. M. Martínez, A. R. Mayol, G. Morell, W. Otaño, R. G. Raptis, and B. R. Weiner. Center for Advanced Nanoscale Materials (CANM) NASA University Research, National Aeronautics and Space Administration, URC, 5 years, October 2008, Multiple PIs, Approved, $6,000,000.
6. C. R. Cabrera, Y. Ishikawa, R. S. Katiyar, G. Morell, and R. G. Raptis. Space Exploration Enabling Power Systems: Partnership to Develop the Fundamental Science at UPR and Perform the Corresponding Proof-of-Concept at NASA GRC, National Aeronautics and Space Administration, EPSCoR, 3 years, October 2007, Multiple PIs, Approved, $1,350,000.

Presentations

1. C. R. Cabrera, G. G. Rodríguez-Calero, and D. Santiago (March 2009) "Characterization of Nano-Catalysts for Direct Methanol Fuel Cell Applications" in 44th ACS Junior Technical Meeting and 29th Puerto Rico Interdisciplinary Scientific Meeting (PRISM).
2. C. R. Cabrera, G. G. Rodríguez-Calero, and D. Santiago (March 2009) "DNA Electrochemical Biosensor Support Using Pt Nanoparticles on Carbon Black" in 44th ACS Junior Technical Meeting and 29th Puerto Rico Interdisciplinary Scientific Meeting (PRISM).
3. C. R. Cabrera, C. Pagan-Miranda, G. Sanchez-Pomales, and L. Santiago-Rodriguez (March 2009) "DNA-Carbon Nanotube Complexes Assembled on Gold Surfaces" in 44th ACS, Puerto Rico Local Chapter, Junior Technical Meeting.
4. L. Arroyo-Ramirez, C. R. Cabrera, and R. G. Raptis (March 2009) "Palladium-Cobalt Precursor for Catalyst Formation on Carbon Surfaces" in 29th Puerto Rico Interdisciplinary Scientific Meeting (PRISM 2009).
5. C. R. Cabrera, L. Santiago-Rodríguez, and G. Sánchez-Pomales (March 2009) "Single-Walled Carbon Nanotubes Modified Gold Surface as DNA Electrochemical Sensor" in 29th Puerto Rico Interdisciplinary Scientific Meeting (PRISM 2009).
6. C. R. Cabrera, L. Echegoyen, D. López, A. Palkar, G. G. Rodríguez-Calero, and D. Santiago (January 2009) "Characterization of Pt/C Nano-Catalysts for Direct Methanol Fuel Cell Applications" in 2009 Southeast Regional Space Grant Meeting.
7. L. Arroyo-Ramirez, C. R. Cabrera, and R. G. Raptis (January 2009) "Palladium-Cobalt Nanoparticles on Carbon Surfaces: An Electrochemical and Surfaces Analysis" in NASA Space Grant Southeast Regional Meeting.
8. C. R. Cabrera, G. Sanchez-Pomales, and L. Santiago-Rodriguez (November 2008) "DNA-Functionalized Carbon Nanotubes as Electrochemical Biosensors" in Nanobiology, Nanomedicine and Innovation for Biotechnology Workshop.
9. C. R. Cabrera, C. Pagan-Miranda, G. Sanchez-Pomales, and L. Santiago-Rodriguez (November 2008) "Carbon Nanotubes Deposited Over Self-Assembled Monolayers on Gold" in Annual Biomedical Research Conference for Minority Students.

10. C. R. Cabrera, G. G. Rodríguez-Calero, and D. Santiago (November 2008) "DNA Electrochemical Biosensor Support Using Pt Nanoparticles on Carbon Black" in Annual Biomedical Research Conference for Minority Students (ABRCMS) 2008.
11. C. R. Cabrera, D. López, G. G. Rodríguez-Calero, and D. Santiago (October 2008) "Characterization of Pt/C Ru/Pt/C Nanocatalysts Prepared by the RoDSE Technique" in 214th Meeting of ECS and Pacific Rim Investigation Meeting of Electrochemistry (PRIME) 2008.
12. C. R. Cabrera, C. Pagan-Miranda, G. Sanchez-Pomales, and L. Santiago-Rodriguez (October 2008) "Assembly of DNA-Carbon Nanotube Complexes on Gold Surfaces" in 214th Meeting of the Electrochemical Society.
13. L. Arroyo-Ramirez, C. R. Cabrera, and R. G. Raptis (October 2008) "Palladium-Cobalt Precursor for Catalyst Formation on Carbon Surfaces" in PRiME 2008.
14. C. R. Cabrera, C. Pagan-Miranda, and G. Sanchez-Pomales (October 2008) "Carbon Nanotubes Deposited Over Self-Assembled Monolayers on Gold" in 214th Meeting of the Electrochemical Society.
15. C. R. Cabrera and D. Suazo (September 2008) "Platinum Surface Decorated with Ruthenium using the Self-Assembled Monolayer Technique" in 59th Annual Meeting of the ISE .
16. C. R. Cabrera, L. Echegoyen, D. López, A. Palkar, G. G. Rodríguez-Calero, and D. Santiago (August 2008) "Characterization of Pt/C Nano-Catalysts for Direct Methanol Fuel Cell Applications" in Pan American Advance Studies Institute (PASI) on Microscopy Technique for Nanomaterials.
17. L. Arroyo-Ramirez, C. R. Cabrera, and R. G. Raptis (August 2008) "Palladium-Cobalt Nanoparticles on Carbon Surfaces: An Electrochemical and Surfaces Analysis" in IFN External Advisory Board Meeting.
18. C. R. Cabrera, L. Santiago-Rodríguez, and G. Sánchez-Pomales (August 2008) "Single-Walled Carbon Nanotubes Modified Gold Surface as DNA Electrochemical Sensor" in XXVIII Latin American Chemistry Congress and PRCHEM 2008 (FLAQ-2008) - Bioanalytical and Biochemistry: Their Role in Bioscience and Biotechnology.
19. C. R. Cabrera, L. Echegoyen, D. López, A. Palkar, G. G. Rodríguez-Calero, and D. Santiago (July 2008) "Characterization of Pt/C Nano-Catalysts for Direct Methanol Fuel Cell Applications" in The 28th Latinamerican Chemical Congress (FLAQ) and Colegio de Químicos de Puerto Rico 67th Annual Conference & Exhibition (PR CHEM 2008).
20. L. Arroyo-Ramirez, C. R. Cabrera, and R. G. Raptis (July 2008) "Palladium-Cobalt Nanoparticles on Carbon Surfaces: An Electrochemical and Surfaces Analysis" in XXVIII Latin American Chemical Congress.
21. C. R. Cabrera, K. H. Griebenow, J. Méndez, E. Nicolau, and R. J. Solá (July 2008) "Adsorption and Biophysical Characterization of Alcohol Dehydrogenase on Diamond Nanoparticles." in XXVIII Congreso Latinoamericano de Química.
22. C. R. Cabrera and D. Suazo (July 2008) "Platinum surface decorated with ruthenium using self-assembled monolayer technique" in 2008 GRC Electrodeposition.

23. C. R. Cabrera, L. Echegoyen, A. Palkar, G. G. Rodríguez-Calero, and D. Santiago (July 2008) "Characterization of Pt/C Nano-Catalysts for Direct Methanol Fuel Cell Applications" in 2008 NASA Glenn Research Center Historically Black Colleges and Universities (HBCUs) and Other Minority Universities (OMUs) Research Conference.
24. C. R. Cabrera, I. González, K. H. Griebenow, and E. Nicolau (July 2008) "Degradation of Urea at Nano-Platinized Boron Doped Diamond Electrodes for Bioregenerative Applications. " in 37th COSPAR Scientific Assembly (Committee on Space Research).
25. C. R. Cabrera, K. H. Griebenow, J. Mendez, E. Nicolau, and R. J. Sola (July 2008) "Adsorption and biophysical characterization of alcohol dehydrogenase on diamond nanoparticles for the development of biomedical fuel cells." in 33rd FEBS Congress & 11th IUBMB Conference.