

Fernando Garzon, Ph.D

*University of New Mexico Professor of Chemical and Biological Engineering
Sandia National Laboratory Faculty Research Scientist
garzon@unm.edu/fhgarzo@sandia.gov*

Brief Biography:

Fernando Garzon holds a joint appointment as a UNM Professor of Chemical and Biological Engineering and a Faculty Research Scientist at Sandia National Laboratory in the 1815 organization, The Advanced Materials Laboratory. He received his B.S.E. in Materials Science and Engineering from the University of Pennsylvania in 1982 and completed his PhD in Materials Science and Engineering with a focal area of Solid State Chemistry in 1988. His research interests include: the development of advanced gas sensors, fuel cell materials technology, energy storage technology, high temperature materials and devices, electronic conducting transition metal oxides, thin film growth, ceramic membrane technology, and solid state ionics. Dr. Garzon also leads a team in the development of advanced explosives forensic technology in support of national security and public safety efforts. Fernando Garzon has co-authored over 140 scientific publications with more than 6000 citations and served as an editor for the Electrochemical Society Publication series, *Solid State Ionic Devices*. He is the inventor of an R&D 100 award winning high temperature combustion control sensor, and a new class of solid-state gas sensors for hydrocarbons, carbon monoxide and nitric oxides. He holds ten patents in electrochemical technology. Fernando was the 2012 Los Alamos Fellow's Prize recipient for Research Leadership, the 2009 DOE Fuel Cell Program Research Award winner, and was recognized in Scientific American's Top 50 Science and Technology Achievements for 2003. He has also made television and radio presentations as a scientific advocate for efficient energy storage and conversion technologies. Fernando Garzon is the Past Chairman of the High Temperature Materials Division of the Electrochemical Society. He was named a Fellow of the Society in 2008, served as Vice President from 2009-2012, and is the President of the Electrochemical Society for 2012-13, Serves on the Council of Past Presidents, and is currently a member of the ECS Technical Affairs committee. He is also a member of the Materials Research Society, the American Ceramics Society, and the American Association for the Advancement of Science.

Education:

PhD University of Pennsylvania - Materials Science and Engineering (1988)
B.S.E. University of Pennsylvania - Materials Science and Engineering (1982)

Positions:

Sandia National Laboratory (2014-current)

Faculty Research Scientist (Distinguished Staff Appointment),
Materials Science Department, 1815 Organization, Advanced Materials Laboratory

University of New Mexico (2014-current)

Professor of Chemical and Biological Engineering,
Chemical and Biological Engineering Department
Member, Center for Microengineered Materials

Los Alamos National Laboratory (1988-2014)

Scientist V; Materials Chemistry Team Leader (9 members, 5 PhD Scientists) Electronic & Electrochemical Materials & Devices Group MPA (MST)-11 (1997-present)
Deputy Group Leader MST-11, (1999-2001)
Technical Project Leader (1994-1997)
Technical Staff Member, MST-11 (1989-1993)
Postdoctoral Fellow (1988-1989)

Scientific Research Areas:

Electrochemical Energy Conversion Technology, Fuel Cells and Batteries
Electrochemical Synthesis Of Fuels and Chemical Feedstocks
Chemical Sensor Development and Sensing With Ionic Devices
Heterogeneous Catalysis and Electrocatalysis
Inorganic Ionic and Nanoporous Membrane Science
Nanotechnology for Energy Conversion
Ceramic Thin and Thick Film Materials Development

Selected Honors and Awards:

Los Alamos National Laboratory 2012 Fellow's Prize for Scientific Leadership
Los Alamos Technology Transfer Award 2010
DOE-EERE Hydrogen and Fuel Cell Program 2009 Award for "Impurity Effects in Polymer Fuel Cells"
Los Alamos Technology Transfer Award 2009
Fellow of the Electrochemical Society 2008 (<2% of membership)
Los Alamos Technology Transfer Award 2007
Fuel Cell Seminar (San Antonio, TX USA) 2004 Best Poster Award
Scientific American's Top 50 Science and Technology Achievements for 2003, Development of Sulfur Tolerant Fuel Cell Anodes
Los Alamos Technology Transfer Award 2003
Los Alamos Technology Transfer Award 2001
R&D 100 Awards 1999 - Sulfur Resistant Oxygen Sensor Technology
Los Alamos Technology Transfer Award 1997
Los Alamos Technology Transfer Award 1996

Professional and Synergistic Activities:

Member, Electrochemical Society, Materials Research Society, American Ceramics Society, American Association for the Advancement of Science, International Society For Solid State Ionics
Member, Los Alamos Science and Engineering Council (Technical advisory board to LANL Director) 2002-2004
Member, Los Alamos LDRD-ER Materials Committee 2001
Member, Los Alamos, Fellows Committee 1997-1998

US-DOE Workshop Invited Participant/Organizer:

Invited Participant, Flow Battery Workshop, DOE-EERE&OE , Washington DC, 2012
Invited Participant, DOE Fuel Cell Pre-Solicitation Workshop, DOE-EERE, Lakewood, CO, 2010
Invited Participant, Japan-METI-DOE, DOE-EERE, Workshop, Albuquerque, NM, 2010
Invited Participant, Advanced Materials for Stationary Electrical Energy Storage DOE-OE, Albuquerque, NM, 2010
Invited Participant, DOE-AIST Fuel Cell Workshop, DOE-EERE/ NEDO AIST, Tokyo, Japan, 2009
Invited Participant, Basic Research Needs For Electrical Energy Storage DOE BES, Washington D.C., 2007
Invited Participant, DOE-AIST Fuel Cell Workshop, DOE-EERE/ NEDO AIST, Tokyo, Japan, 2007
Workshop Organizer, Hydrogen Sensor Workshop, DOE-EERE, Washington DC, 2007
Invited Participant, Basic Research Needs for the Hydrogen Economy DOE-BES, Rockville MD, 2003
Invited Participant, Hydrogen Storage Pre-Solicitation Workshop DOE-EERE, Washington DC, 2003
Workshop Organizer, Sensor Needs and Requirements for Fuel Cell and CIDI/SIDI DOE-EERE, Washington DC, 2000
Invited Participant, Workshop on Solid Oxide Fuel Cells for Transportation, DOE-FE&EERE 1995, Towson, MD

Invited Participant, Phase Diagrams for High T_c Superconductors NIST/DOE BES Santa Fe, New Mexico 1993

Invited Presentations:

Invited Speaker, European Hydrogen Conference, Seville, Spain, 2014

Invited Speaker, 226 Meeting of The Electrochemical Society, Orlando Florida, 2014

Invited Speaker, International Meeting on Chemical Sensors, Buenos Aires, Argentina, 2014

Invited Plenary Session Speaker, 80th Meeting of the Electrochemical Society of Japan, Sendai, Japan 2013

Invited Keynote Speaker, 54th Annual Meeting on Chemical Sensors Japan, 2013

Invited Keynote Speaker, NSF Energy Workshop, National High Magnetic Field Laboratory FSU, FL 2012

Invited Speaker, Electrochemical Society Bay Area Section Meeting, Berkeley CA, 2012

Invited Speaker, Electrochemical Society Detroit Section Meeting, Dearborn, MI, 2012

Invited Speaker, Electrochemical Society Georgia Section Meeting, Atlanta, GA, 2011

Invited Keynote Speaker, Polymer Electrolyte Fuel Cells, 216th Meeting of the Electrochemical Society, Vienna, Austria, 2009

Invited Speaker, Gordon Research Conference, Fuel Cells, 2008

Invited Speaker, International Meeting on Chemical Sensing 12, Columbus Ohio, 2008

Invited Keynote Speaker, Fuel Cell Expo/FC-Cubic Workshop, Tokyo, Japan, 2007

Invited Keynote Speaker, International Society for Solid State Ionics 14, Monterey, CA, 2003

Invited Keynote Speaker, International Conference on Advanced Ceramics and Composites American Ceramic Society, Cocoa Beach FL, 2005

Books:

Performance Impact Of Cationic Contaminants, *Handbook of Fuel Cells*, Wiley, 2010

Effects Of Contaminants On Catalyst Activity, *Handbook of Fuel Cells*, Wiley, 2010

Patents:

US Patent #7,589,047: F. A. Uribe, M. Wilson and F. H. Garzon. "*Composite materials and method of making*"

US Patent #7,575,709: R. Mukundan, E. L. Brosha and F. H. Garzon. "*Tape-cast sensors and method of making*"

US Patent #7,736,547: F. H. Garzon, M. L. Einsla and R. Mukundan. "*Method of synthesis of proton conducting materials*"

US Patent #7,264,700: F. H. Garzon, E. L. Brosha, R. Mukundan. "*Thin film mixed potential sensors*"

US Patent #7,214,333: R. Mukundan, E. L. Brosha, F.H. Garzon. "*Electrodes for solid state gas sensor*"

US Patent #6,656,336: R. Mukundan, E. L. Brosha and F. H. Garzon. "*Method for forming a potential hydrocarbon sensor with low sensitivity to methane and CO*"

US Patent #6,605,202: R. Mukundan, E. L. Brosha and F. H. Garzon. "*Electrodes for solid state gas sensor*"

US Patent #6,277,256: F. H. Garzon and E. L. Brosha. "*Enhanced electrodes for solid state gas sensors*"

US Patent #5,695,624: F. H. Garzon and E. L. Brosha. "*Solid state oxygen sensor*"

US Patent #5,543,025: F. H. Garzon, B.W. Chung, I. D. Raistrick, and E. L. Brosha. "*Solid state oxygen sensor*"

Industrial Collaborations:

Ford Motor Company, Electroscience Laboratories, DuPont, General Motors, Chrysler, Caterpillar, Cummins, Ceramatic/CoorsTEK, Emisense, Rosemount Analytical, Zircoa

University Collaborations:

University of New Mexico; New Mexico Institute of Technology; University of Pennsylvania; Massachusetts Institute of Technology; University of Wisconsin, Madison; Rutgers, Madison; University of California, Los Angeles; University of California, Riverside; University of Delaware; Tokyo Institute of Technology; University of Florida; University of Washington, Pullman

Publications last 3 years (Over 140 total ~6500 citations, H index-34, I₁₀ index- 70 (Google Scholar)

- 1 Woo, L. Y. *et al.* Humidity Tolerance of Electrochemical Hydrogen Safety Sensors Based on Yttria-Stabilized Zirconia (YSZ) and Tin-doped Indium Oxide (ITO). *ECS Transactions* **45**, 19-31, (2013).
- 2 Sekhar, P. K. *et al.* Impedance Spectroscopy based Characterization of an Electrochemical Propylene Sensor. *Sensors and Actuators, B: Chemical* **177**, 111-115, (2013).
- 3 Sansiñena, J. M., Wilson, M. S. & Garzón, F. H. Conductive Nanostructured Materials for Supported Metal Catalysts. *ECS Transactions* **50**, 1693-1699, (2013).
- 4 Matanović, I., Kent, P. R. C., Garzon, F.H. & Henson, N. J. Theoretical Study of the Structure, Stability and Oxygen Reduction Activity of Ultrathin Platinum Nanowires. *ECS Transactions* **50**, 1385-1395, (2013).
- 5 Matanović, I., Kent, P. R. C., Garzon, F.H. & Henson, N. J. Density Functional Study of the Structure, Stability and Oxygen Reduction Activity of Ultrathin Platinum Nanowires. *Journal of the Electrochemical Society* **160**, F548-F553, (2013).
- 6 Kreller, C. R. *et al.* Application of Commercial Manufacturing Methods to Mixed-Potential NO_x Sensors. *ECS Transactions* **50**, 307-314, (2013).
- 7 Alia, S. M. *et al.* Platinum Coated Copper Nanowires and Platinum Nanotubes as Oxygen Reduction Electrocatalysts. *ACS Catalysis* **3**, 358-362, (2013).
- 8 Sekhar, P. K. *et al.* Packaging and Testing of a Hydrogen Safety Sensor Prototype. *International Journal of Hydrogen Energy* **37**, 14707-14713, (2012).
- 9 Matanović, I., Kent, P. R. C., Garzon, F. H. & Henson, N. J. Density Functional Theory Study of Oxygen Reduction Activity on Ultrathin Platinum Nanotubes. *Journal of Physical Chemistry C* **116**, 16499-16510, (2012).
- 10 Lopes, T., Kim, D. S., Kim, Y. S. & Garzon, F. H. Ionic Transport and Water Vapor Uptake of Ammonium Exchanged Perfluorosulfonic Acid Membranes. *Journal of the Electrochemical Society* **159**, B265-B269, (2012).
- 11 Lopes, T., Chlistunoff, J., Sansiñena, J. M. & Garzon, F. H. Oxygen Reduction Reaction on a Pt/Carbon Fuel Cell Catalyst in the Presence of Trace Quantities of Ammonium Ions: An RRDE Study. *International Journal of Hydrogen Energy* **37**, 5202-5207, (2012).
- 12 Wilson, M. S., Delariva, A. & Garzon, F. H. Synthesis of Sub-2 nm Ceria Crystallites in Carbon Matrixes by Simple Pyrolysis of Ion-Exchange Resins. *Journal of Materials Chemistry* **21**, 7418-7424, (2011).
- 13 Sekhar, P. K. *et al.* Trace Detection and Discrimination of Explosives using Electrochemical Potentiometric Gas Sensors. *Journal of Hazardous Materials* **190**, 125-132, (2011).
- 14 Sansiñena, J. M., Nelson, M., Wilson, M.S. & Garzón, F.H. Electrochemical Synthesis of Oxygen Reduction Catalysts Based on Pt Coated Polypyrrole Nanowires Using Starch as Template Molecule. *ECS Transactions* **33**, 13-19, (2011).
- 15 Mitri, F. G., Garzon, F. H. & Sinha, D. N. Characterization of Acoustically Engineered Polymer Nanocomposite Metamaterials using X-Ray Microcomputed Tomography. *Review of Scientific Instruments* **82**, (2011).
- 16 Matanović, I., Garzon, F. H. & Henson, N. J. Theoretical Study of Electrochemical Processes on Pt-Ni Alloys. *Journal of Physical Chemistry C* **115**, 10640-10650, (2011).

- 17 Kienitz, B., Pivovar, B., Zawodzinski, T. & Garzon, F. H. Cationic Contamination Effects on Polymer Electrolyte Membrane Fuel Cell Performance. *Journal of the Electrochemical Society* **158**, B1175-B1183, (2011).
- 18 Johnston, C. M. *et al.* Se-Modified Ru Nanoparticles as ORR Catalysts - Part 1: Synthesis and Analysis by RRDE and in PEFCs. *Journal of Electroanalytical Chemistry* **662**, 257-266, (2011).
- 19 Chlistunoff, J., Wilson, M. & Garzón, F. Electrochemical Studies of Novel Pt/Ceria/C Oxygen Reduction Catalysts for Fuel Cells. *ECS Transactions* **41**, (2011).
- 20 Challa, S. R. *et al.* Relating Rates of Catalyst Sintering to the Disappearance of Individual Nanoparticles during Ostwald Ripening. *Journal of the American Chemical Society* **133**, 20672-20675, (2011).
- 21 Wu, G. *et al.* Titanium Dioxide-Supported Non-Precious Metal Oxygen Reduction Electrocatalyst. *Chemical Communications* **46**, 7489-7491, (2010).
- 22 Toops, T. J. *et al.* Pre-Oxidized and Nitrided Stainless Steel Alloy Foil for Proton Exchange Membrane Fuel Cell Bipolar Plates. Part 2: Single-Cell Fuel Cell Evaluation of Stamped Plates. *Journal of Power Sources* **195**, 5619-5627, (2010).
- 23 Sekhar, P. K. *et al.* Development and Testing of a Miniaturized Hydrogen Safety Sensor Prototype. *Sensors and Actuators, B: Chemical* **148**, 469-477, (2010).
- 24 Sekhar, P. K. *et al.* Effect of Yttria-Stabilized Zirconia Sintering Temperature on Mixed Potential Sensor Performance. *Solid State Ionics* **181**, 947-953, (2010).
- 25 Sekhar, P. K. *et al.* Application of Commercial Automotive Sensor Manufacturing Methods for NO_x/NH₃ Mixed Potential Sensors for On-Board Emissions Control. *Sensors and Actuators, B: Chemical* **144**, 112-119, (2010).
- 26 Sekhar, P. K., Brosha, E. L., Mukundan, R. & Garzon, F. H. Chemical Sensors for Environmental Monitoring and Homeland Security. *Electrochemical Society Interface* **19**, 35-40, (2010).
- 27 Sekhar, P. K., Brosha, E. L., Mukundan, R., Farber, B. & Garzon, F. H. Statistical investigation of a novel conditioning method for reliable detection of exhaust gas components, (2010).
- 28 Sekhar, P. K. *et al.* Effect of Electrolyte Sintering Temperature on Mixed Potential Sensor Performance. *ECS Transactions* **25**, 19-27, (2010).
- 29 Sekhar, P. K., Brosha, E., Mukundan, R., Farber, B. & Garzón, F. H. Statistical Investigation of a Novel Conditioning Method for Reliable Detection of Exhaust Gas Components. *ECS Transactions* **33**, 101-110, (2010).
- 30 Brosha, E. L. *et al.* Development of Sensors and Sensing Technology for Hydrogen Fuel Cell Vehicle Applications. *ECS Transactions* **26**, 475-483, (2010).
- 31 Brosha, E. L., Rockward, T., Uribe, F. A. & Garzon, F. H. Measurement of H₂S Crossover Rates in Polymer Fuel Cell Membranes using an Ion-Probe Technique. *Journal of the Electrochemical Society* **157**, B180-B186, (2010).
- 32 Berliba-Vera, E. K., Delariva, A. T., Atanassov, P., Datye, A. K. & Garzón, F. H. Nucleation of Platinum on Carbon Blacks. *ECS Transactions* **33**, 73-82, (2010).