Eugene Smotkin obtained his PhD at the University of Texas studying Photoelectrochemical Energy Conversion. Smotkin is internationally renowned for high throughput catalyst screening and *in operando* XAS and FTIR spectroscopy. He was an Olaf A. Hougen speaker at the UW Madison Chemical Engineering Department in 2003, and the chair and organizer of the 4th International Workshop on Combinatorial Materials Science and Technology in San Juan Puerto Rico, 2006. He founded NuVant Systems Inc., a fuel cell catalysis company in 1999.

San Jose State University	Chemistry	B.S.	1976
San Francisco State University	Chemistry	M.S.	1984
University of Texas at Austin	Chemistry	Ph.D.	1989
University of Hawaii	Postdoc	1990-1991	
Argonne National Laboratories	Postdoc	1991-1992	

January 2007	Northeastern University	Prof. Chemistry
2005 – Date:	University of Puerto Rico:	Prof. Chemistry
2002 – 2005:	University of Puerto Rico:	Assoc. Prof. Chemistry
1998 – 2002:	Illinois Institute of Technology:	Assoc. Prof. Chemical Engineering
1996 – 1998:	Illinois Institute of Technology:	Assist. Prof. Chemical Engineering
1992 – 1996:	Illinois Institute of Technology:	Assist. Prof. Chemistry

Research interests

Catalysis, PEM Fuel Cells, Physical Electrochemistry, Reaction Engineering, Mass Spectrometry, Combinatorial Materials Discovery, Applied Quantum mechanics

Selected professional activities

2006, Chair and organizer of the 4th U.S.-Japan workshop on Combinatorial Materials Science & Technology, San Juan, PR, December 6-9, 2006

2006, Chair and organizer, Symposium on Physical and Computational Characterization of nanostructured Electrocatalysts, 232nd ACS National meeting, San Francisco, CA, Sept. 10 – 14, 2006

2002, Symposium Chair and Organizer at Orlando 223rd ACS National Meeting, Electrocatalysis and Fuel Cells, April 7-11, 2002

1999, Workshop Chair and Organizer: ARO Workshop on Designed Catalysts for Fuel Processors and Fuel Cells, Chicago, IL April 18-21, 1999

Key Lectures

Heyrovsky Discussions, Heyrovsky Institute, Prague, Czech Republic, **2005**

Gordon Conference, Bristol, RI, **2004**

Olaf A. Hougen Lecturer, University of Wisconsin Hougen Symposium, **2003**

US Army Research Office, Theory and Surface Measurements of Fuel Cell Catalysts Workshop, Denmark, **2003**.

Gordon Conference, New London, NH, **1999**

Gordon Conference, Ventura, CA, **1999**

Patents

1. E.S. Smotkin "Heat Activated Membrane Introduction Apparatus and Method for Screening Materials" U.S. Patent 6,923,939 B1, **2005**

2. E.S. Smotkin, "High throughput screening device for combinatorial chemistry" USP 6,692,856 B2, **2004**

3. T.E. Mallouk, E. S. Smotkin, B. C. Chan, E. Reddington, B. Gurau, R. Viswanathan, A. Sapienza, R. Liu, and G. Chen, "Electrocatalyst Compositions," USP 6,284,402, **2001**.

4. E.S. Smotkin, et al., "Single Phase Ternary Pt-Ru-Os Catalysts for Direct Oxidation Fuel Cells" USP 5,856,036, **1999**

5. E.S. Smotkin, et al., "Hybrid Electrolyte System" USP 5,846,669, **1998**

6. E.S. Smotkin, A. J. Bard and M. A. Fox, "Photoelectrochemical Cell for Unassisted Photocatalysis and Photosynthesis," USP 4,793,910, **1988**

7. E.S. Smotkin, "Hydrogen permeable membrane for fuel cells, and partial reformate fuel cells" USP 20020031695, **pending**

Publications

1. Stanislav Stoupin, Harry Rivera, Zhengrong Li, Carlo U. Segre, Carol Korzeniewski, Dominick J. Casadonte, Jr., Hisashi Inoue and Eugene S. Smotkin, "*Structural analysis of sonochemically prepared PtRu versus Johnson Matthey PtRu in operating direct methanol fuel cells"* Phys. Chem. Chem. Phys., 10, 6430-6437 **(2008)**
2. Harry Rivera, Jamie S. Lawton, David E. Budil and Eugene S. Smotkin, *"The effect of sorbed methanol, current and temperature on multi-component transport in Nafion based direct methanol fuel cells"* **J. Phys. Chem. B,** 112, (29) 8542-8548 **(2008)**
3. Jamie S. Lawton, Eugene S. Smotkin and David E. Budil, *"ESR Investigation of Microviscosity, Microscopic Ordering, and Local Polarity of Methanol and Water in Nafion Membranes"* **J. Phys. Chem. B**, 112 (29) 6549-8557, **(2008)**
4. Zhen-Bo Wang, Harry Rivera, Xin-Peng Wang, Hong-Xin Zhang, Peter-Xian Feng, Emily A. Lewis and Eugene S. Smotkin, *"Catalyst failure analysis of a direct methanol fuel cell membrane electrode assembly*" **Journal of Power Sources**, 177, (2), pp 386-392 **(2008)**
5. Smotkin, E. S., "*Proton spillover promoted non-Faradaic reactions at polymer electrolyte fuel cell cathodes"* in Conference Proceedings of First International Conference on the Origin of Electrochemical Promotion of Catalysis, Tsiplakides, D., Balomenenou, Eds., CPERI-CERTH, ISBN 978-960-98231-0-4 Greece, pp. 14 – 19, **2008**
6. Smotkin, E. S., "*FTIR and X-Ray Absorption Spectroscopy of Operating Fuel Cells*". In **In-Situ Spectroscopic Studies of Adsorption at the Electrode and Electrocatalysis", 1st ed.**; Sun, S.-G.; Christensen, P. A.; Wieckowski, A., Eds. Elsevier: Oxford, UK, pp 247-272, **(2007)**
7. S. Stoupin, Eun-Hyuk Chung, S. Chattopadhyay, C.U. Segre, E.S. Smotkin, *"Pt and Ru X-ray Absorption Spectroscopy of PtRu Anode Catalysts in Operating Direct Methanol Fuel Cells "* **J. Phys. Chem. B**, 110 (20), 9932 -9938, **(2006)**
8. Hou, Guoyan; Smotkin, Eugene S. "*Potential-dependent CO adsorption on a smooth surface of crystalline Pt by the use of PEM-FTIR"* ECS Transactions 1(17, Molecular Structure Effects in Heterogeneous Electron Transfer Kinetics), 1-7. **(2006)**
9. M. Salazar, E.S. Smotkin, "*Electrochemically promoted olefin isomerization reactions at polymer electrolyte fuel cell membrane electode assemblies",* **Journal of Applied Electrochemistry**, 36(11) 1237-1240 **(2006)**
10. R. Basnayake, Z. Li, S. Katar, W. Zhou, H. Rivera, E.S. Smotkin, D.J. Casadonte, C. Korzeniewski, "*PtRu Nanoparticle Electrocatalyst with Bulk Alloy Properties Prepared through a Sonochemical Method"* **Langmuir**, 22(25) 10446-10450, **(2006)**
11. Stanislav Stoupin, Eun-Hyuk Chung, Soma Chattopadhyay, Carlo.U. Segre, Eugene S. Smotkin, "Pt and Ru X-ray Absorption Spectroscopy of PtRu Anode Catalysts in Operating Direct Methanol Fuel Cells " **J. Phys. Chem. B**, 110 (20), 9932 -9938, **(2006)**

12. Eugene S. Smotkin, Junhua, Jiang, Amit Nayar, Renxuan Liu, "*High-throughput screening of fuel cell electrocatalysts*" **Applied Surface Science,** 252; 2573-2579**, (2006)**
13. P. K. Babu, H. S. Kim, S. T. Kuk, J. Ho Chung, Eric Oldfield, Andrzej Wieckowski, E. S. Smotkin, "*Activation of Nanoparticle Pt-Ru Fuel Cell Catalysts by Heat Treatment: A 195Pt NMR and Electrochemical Study* "**, J. Phys. Chem. B.**; 109(36); 17192-17196 (**2005**).
14. N. Dimakis, H. Iddir, R. R. Díaz-Morales, Renxuan Liu, Grant Bunker, Eun-Hyuk Chung and E. S. Smotkin "*A Band Dispersion Mechanism for Pt Alloy Compositional Tuning of Linear Bound CO Stretching Frequencies"*, **J. Phys. Chem. B,** *109*, 1839-1848 **(2005)**
15. B. C. Chan, R. Liu, K. Jambunathan, H. Zhang, G, Chen, T. E. Mallouk, and E. S. Smotkin, "*Comparison of High Throughput Electrochemical Methods for Testing Direct Methanol Fuel Cell Anode Electrocatalysts*," **J. Electrochem Soc**, **152,** A594-A600 (**2005**)
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17. Mallouk, T. E.; Ramnarayanan, R.; Jambunathan, K.; Chen, G.; Chan, B. C.; Smotkin, E. S.; Liu, R.; Gurau, B.; Sun, Y.; Nayar, A.; Kim, Y.; Willis, R. R.; Bare, S. R. **"***New synthetic and screening methods for libraries of heterogeneous catalysts and electrocatalysts."* **PMSE Preprints** 90 651. **(2004)**
18. A. Nayar, Y. Kim, J. Rodriguez, R. Willis, D. Galloway, F. Falih, and E. Smotkin, " *High Speed Laser Activated Membrane Introduction Mass Spectrometric Evaluation of Bulk Methylcyclohexane Dehydrogenation Catalysts*" **Applied Surface Science**, 223, **(2004),** 118-123
19. T. E. Mallouk and E. S. Smotkin "*Combinatorial Catalyst Development Methods*" Vol 2, part 3, pp 334 – 347, In **Handbook of Fuel Cells – Fundamentals, Technology and Applications**, Edited by Wolf Vielstich, Arnold Lamm, Hubert A. Gasteiger, John Wiley & Sons, LTD, Chichester, **(2003)**
20. Eugene S. Smotkin and Robert R. Diaz-Morales, "*New Electrocatalysts by Combinatorial Methods"* in **Annual Reviews of Material Research**, 33, pp 557 - 579 **(2003)**
21. Bogdan Gurau, E. S. Smotkin, " *Methanol Crossover in Direct Methanol Fuel Cells: A Link Between Power and Energy Density*" **Journal of Power Sources** 112, **(2002)** 339-352
22. Renxuan Liu, E. S. Smotkin, "*Array Membrane Electrode Assemblies For High Throughput Screening of Direct Methanol Fuel Cell Catalysts*" **Journal of Electroanalytical Chemistry**, 535, **(2002)** 49-55
23. Amit Nayar, Renxuan Liu, Robert J. Allen, Michael J. McCall, Richard R. Willis, and Eugene S. Smotkin, "*Laser-Activated Membrane Introduction Mass Spectrometry for High-Throughput Evaluation of Bulk Heterogeneous Catalysts*" **Analytical Chemistry**, 74, 9, **(2002)** 1933-1938
24. Ramesh Viswanathan, Renxuan Liu and Eugene S. Smotkin, "*In-situ X-ray Absorption Fuel Cell*" **Review of Scientific Instruments**, Vol. 73, Issue 5, **(2002)**, 2124-2127
25. Han-Wei Lei, Sanghyuk Suh, Bogdan Gurau, Bizuneh Workie, Renxuan Liu, Eugene S. Smotkin, "*Deuterium Isotope Analysis of Methanol Oxidation on Mixed Metal Anode Catalysts*" **Electrochimica Acta**, 47, **(2002)** 2913-2919
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42. E. Reddington, A. Sapienza, B. Gurau, R. Viswananthan, S. Sarangapani, E. S. Smotkin, T. E. Mallouk, "*Combinatorial Electrochemistry: A Highly Parallel, Optical Screening Method for the Discovery of Better Electrocatalysts*", **Science**, 280, 1735 - 1739 **(1998)**
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Contributed presentations

1. Fuccillo, M. K.; Stoupin, S; Lewis, E; Rivera, H; Grice, C; Ramaker, D; Jia, Q; Segre, C; Smotkin, ES; Oral Presentation. "In-situ Surface Enhanced X-ray Absorption Spectroscopy of Operating Fuel Cells." Electrochemical Society 213th Meeting. Phoenix Convention Center, Phoenix, AZ. 18-23 May 2008.
2. Fuccillo, MK; Dimakis, N; Smotkin, ES; Oral Presentation. "Coverage dependent CO adsorption on subnanoscale Pt(100) crystallites characterized by density-functional theory and classical dipole-dipole electrostatics." Electrochemical Society 212th Meeting. Hilton Hotel, Washington, DC. 7-12 October 2007.
3. Rivera, H., Smotkin E. S.; The Effect of Local Component Concentrations, Current Density and Temperature on Transport Characteristics of Direct Methanol Fuel Cells, 212th ECS meeting at Washington DC, October 11, 2007
4. Rivera, H., Smotkin E. S.; The Effect of Local Component Concentrations, Current Density and Temperature on Transport Characteristics of Direct Methanol Fuel Cells, Oral Presentation at 212th ECS meeting at Washington DC on October 11, 2007.

Invited Lectures

1. *In-situ spectroscopy of operating fuel cells*, Keynote; National Organization for the Professional Advancement of Black Chemists and Chemical Engineers Conference, Philadelphia, PA, March 20, 2008.
2. *Proton spillover promoted non-Faradaic reactions at polymer electrolyte fuel cell cathodes*, Keynote; Presented at the 1st International conference on the Origin of Electrochemical Promotion of Catalysis, CPERI/CERTH, Thessaloniki, Greece, October 1-5 2007

3. *In-situ spectroscopy of operating fuel cells*, Department of Chemical Engineering, Carnegie Mellon University, Pittsburg, PA, November 1, 2007.
4. *The Effect of Alloying Ru into Pt on Bonding Electronics of CO on Pt* National Synchrotron Light Source, Brookhaven National Laboratory, Upton, New York on July 11, 2006
5. *EXAFS, NEXAFS Analysis of PtRu Catalysts Coupled with DFT Modeling*, An International Symposium on Surface Imaging / Spectroscopy at the Solid / Liquid Interface, May 28 - June 1, 2006, Krakow, Poland
6. Keynote lecturer: Workshop on Opportunities in Nanocatalysis, Hosted by the Center for Functional Nanomaterials, Brookhaven National Laboratory, Tarrytown House, Tarrytown, New York, October 19-21, 2005
7. *Dissection of a fuel cell catalyst by XAS, XRD and FTIR*, Keynote lecture, Heyrovsky Discussions, Heyrovsky institute, Prague, Czech Republic, June 13, 2005
8. Gordon Conference on Fuel Cells, *X-ray absorption spectroscopy and FTIR of membrane electrode assemblies in fully operating fuel cells* July 25 – 30, 2004, Bristol, RI
9. "*The Development of Combinatorial Methods for Discovery of Fuel Cell Electrocatalysts*" Olaf A. Hougen Lecturer, University of Wisconsin Hougen Symposium, Department of Chemical Engineering, University of Wisconsin-Madison, September 17 – 18, 2003
10. "*Fuel Cells Operating in the "GAP" Temperature Regime*", Keynote Lecture: 226th American Chemical Society National Meeting, Fuel Cell Systems and Fuel Processing for Fuel Cell Applications Symposium, New York City, September 11, 2003.
11. *Correlation of FTIR of CO/(Pt, alloys) with XRD, DFT and XANES Experiments and Simulations*, US Army Research Office Sponsored Workshop on Theory and Surface Measurements of Fuel Cell Catalysts, University of Denmark, Lyngby, Denmark, June 17, 2003.
12. *XRD Analysis of Nanostructured Electrocatalysts: Applications of Vegard's Law*, US Army Research Office Sponsored Workshop on Theory and Surface Measurements of Fuel Cell Catalysts, University of Denmark, Lyngby, Denmark, June 16, 2003.
13. *Correlation of FTIR of CO/(Pt, alloys) with XRD, DFT and XANES Experiments and Simulations*, US Army Research Office Sponsored Workshop on Theory and Surface Measurements of Fuel Cell Catalysts, University of Denmark, Lyngby, Denmark, June 17, 2003
14. *XRD Analysis of Nanostructured Electrocatalysts: Applications of Vegard's Law*, US Army Research Office Sponsored Workshop on Theory and Surface Measurements of Fuel Cell Catalysts, University of Denmark, Lyngby, Denmark, June 16, 2003
15. *High Throughput Screening and Preparation of Fuel Cell System Catalysts*, 1st International Conference on Polymer Batteries and Fuel Cells, Jeju Island, Korea, June 2, 2003
16. *High Throughput Fundamental Studies of Fuel Cell Catalysts*, 203rd Meeting - Paris, France, Palais des Congres de Paris, May 1, 2003, April 27 - May 2, 2003.
17. *Correlation of FTIR of CO/(Pt Alloys) with DFT and XANES Experiments and Simulations*, May 1, 2003, 203rd Meeting - Paris, France, Palais des Congres de Paris, April 27 - May 2, 2003
18. *Challenges to DMFC Commercialization*, Knowledge Foundation's 5th International Symposium: Small Fuel Cells, New Orleans, LA, May 8, 2003
19. *Correlation of FTIR of CO/(Pt Alloys) with DFT and XANES Experiments and Simulations*, Army Research Office Sponsored Second International Conference on Elementary Processes in Molecule-Metal Surface Interactions, Intercontinental Hotel, San Juan, Puerto Rico, May 7, 2003
20. *Array Membrane Electrode Assemblies for High throughput Screening of fuel Cell Electrocatalysts*, BCC Conference: Fuel Cells 2003, Stamford CT, April 1, 2003
21. *Combinatorial Discovery of Fuel Cell Electrocatalysts*, Department of Energy, Non-Platinum Electrocatalysts Workshop, New Orleans, Louisiana, March 21, 2003
22. *Laser-Activated Membrane Introduction Mass Spectrometry for High-Throughput Evaluation of Bulk Heterogeneous Catalysts*, The Second U.S.-Japan workshop on Combinatorial Materials Science & Technology, Winter Park, CO, December 10, 2002
23. *Array Membrane Electrode Assemblies for High Throughput Screening of Direct Methanol Fuel Cells*, 202nd Meeting of the Electrochemical Society, Salt Lake City, Utah, October 24, 2002

24. *High Throughput Screening of Fuel Cell System Catalysts*, 4th International Symposium on Electrocatalysts: From Theory to Industrial Applications, Villa Olmo, Como, Italy, September 23, 2002
25. *Deuterium Isotope Analysis of Methanol Oxidation on Mixed Metal Fuel Cell Anode Catalysts*, International Catalysis Workshop for Young Scientists (ICWYS-2001) Beijing, China, Sept. 24, 2001
26. *FTIR, XANES and DFT Calculations On Pt Based Fuel Cell Catalysts*, ARO Workshop on Application of First-Principles-Based Computational Methods to the Design of Electrochemical Power Systems ,Berkeley, CA August 31, 2001
27. *Methanol and CO Electrooxidation on Pt, Ru, and Pt based Mixed Metal Catalysts*, Chicago National Meeting of the American Chemical Society, August 30, 2001
28. *Direct Methanol Fuel Cell Catalysis*, Knowledge Foundation's Small Fuel Cells and Battery Technologies for Portable Power Applications Renaissance Hotel, Washington, D.C., April 24, 2001
29. *Combinatorial Discovery of Fuel Cell Catalysts: A Feedback Loop Between Rational Heuristics and High Throughput Screening*, The First Japan-US Workshop on Combinatorial Material Science and Technology, Sheraton Maui Hotel Convention Center, Maui, Hawaii, October 2, 2000
30. *Deuterium Isotope Analysis of Methanol Oxidation Kinetics*, The 2000 International Chemical Congress of Pacific Basin Societies, Honolulu, Hawaii, , Dec 14-19, 2000
31. *Combinatorial Discovery of New Electrocatalysts for Fuel Cells*, Florida Catalysis Conference, University of Florida, April 18, 2000
32. *Combinatorial Discovery of New Electrocatalysts for Fuel Cells: Optical Screening Methods*, Cambridge Healthtech Institute, Engineered Catalysis, New Orleans, Louisiana, December 9 - 10, 1999
33. *Combinatorial Discovery of Electrocatalysts for Direct Methanol Fuel Cells*, NATO Meeting, Frontiers in Molecular Diversity: From Biology to Material Science" Moscow, Russia, Sept. 19, 1999
34. Gordon Conference: *Combinatorial Design of Electrocatalysts*. New London, NH, June 20-25, 1999
35. *FTIR and Mass Spectroscopic Analysis of NEMCA Olefin Isomerization Reactions*, Electrocatalysis ection at the 12th International Conference on Solid State Ionics. Thessaloniki, Greece, June 8, 1999
36. Gordon Conference: *Rational and Irrational Routes to Better Electrocatalysts*. Ventura, CA, January 1999
37. *Array Fuel Cells for High Throughput Screening of Electrocatalysts*, Department of Chemical Engineering, Notre Dame University, September 30, 2003
38. *High Throughput Screening and Preparation of Fuel Cell System Catalysts*, Kwangju Institute of Science and Technology, Gwangju, Korea, June 5, 2003
39. *Analytical Methodologies for Combinatorial Discovery of Heterogeneous Catalysts*, University of Puerto Rico @ Rio Piedras, July 2001
40. *Linking Rational Heuristics to Combinatorial Discovery of Electrocatalysts*, Bowling Green State University, February 16, 2000
41. *Polarization Modulated FTIR of CO Adsorbed on Arc-melted Pt, PtRu and PtRuOs Electrode Surfaces*, Department of Chemistry, Columbia University, New York, September, 1999
42. *In-situ FTIR of CO Adsorbed on Arc-melted Pt Alloys*, Department of Chemistry, University of Texas at Austin, December, 18, 1998
43. *High Throughput Screening and Fundamental Studies of Fuel Cell Catalysts*, Cabot-Superior Micro-Powders, 3740 Hawkins NE, Albuquerque, NM, August 5, 2003

Degrees Granted

1. Harry Rivera, Ph.D., Chemistry, University of Puerto Rico, December, 2008.
2. R. Kim, Ph.D. Chem. Eng. Laser Activated Membrane Introduction Mass Spectrometry, 7/05
3. S. Suh, Ph.D. Chem. Eng.; Isotopic Studies of Methanol and Formic Acid Oxidation, 7/03
4. R. Viswanathan, Ph.D.; Chem. Eng. In-situ X-Ray absorption and electrochemical study of electrocatalysts for polymer electrolyte membrane (PEM) fuel cells 5/02
5. B. Gurau, Ph.D. Chem. Eng. Direct methanol fuel cells: Catalysis and engineering aspects 5/02
6. A. Nayar, M.S. Chem. Eng. High precision, high throughput evaluation of bulk water-gas-shift catalysts by laser activated membrane introduction mass spectrometry (LAMIMS) 7/01
7. U. Rao, M.S. Chem. Eng. Membrane development for intermediate temperature fuel cell systems 7/01
8. E. Kernerman, M.S. Chem. Eng.; The Role of CO_{ads} islands in methanol oxidation on Pt anode: Investigation by cyclic voltammetry and deuterium isotope substitution 7/00
9. M.D. Salazar, Ph.D. Chem. Eng. Cathodic hydrogenation of unsaturated hydrocarbons in a polymer electrolyte fuel cells 7/00
10. R. Kim, M.S. Chem. Eng. The effect of various plasticizers on the transport and electrochemical properties of high molecular weight PEO-based polymer electrolytes 12/99
11. R. Liu, Ph.D. Chemistry; "FTIR surface spectroscopy and electrochemical studies of catalysts for direct methanol fuel cells" 5/98
12. L. Liu, M.S. Chemistry; "Oxidation of methanol on single phase alloys comprised of Pt, Ru, and Os 7/98
13. W. Nie M.S. Chemistry Methanol electro-oxidation and methanol crossover in direct methanol fuel cells 5/96