



Curriculum Vita
Robert J. Farrauto, Ph.D.
Professor of Professional Practice
Earth and Environmental Engineering
Columbia University in the City of New York
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Personal

Birth Date: November 22, 1941 /New York City

Gender: Male

Citizenship: United States of America

Status: Married with two children/six grandchildren, two step-daughters

Education

Ph.D. Chemistry, 1968, Rensselaer Polytechnic Institute, Troy, New York

Advisor: David Aikens

B.S. Chemistry, 1964, Manhattan College, Bronx, New York

Current Employment Experience

September 2012- present: Professor of Professional Practice, Columbia University, Earth and Environmental Engineering Department, Columbia University in the City of New York, 10027 USA

Currently supervise three PhD and three master's degree students engaged in catalysis research. Catalytic air pollution control, hydrogen generation, carbon dioxide capture and upgrading

Teaches two graduate courses (1, 2) and two undergraduate courses (3,4)

1) "Catalysis for Emission Control" 2) Industrial Catalysis, 3) "Pollution Reduction and Environmental Control" 4) "Senior Design (Capstone)"

Industrial Employment

2008-retired August 2012:

Research Vice President, BASF Catalysts (formerly Engelhard),

25 Middlesex-Essex Turnpike, Iselin, New Jersey 08830

Managed a team developing catalysts and adsorbents for the Hydrogen Economy

1976-1990:

Manager of Chemical and Environmental Catalysts

Managed a team of scientists and engineers developing advanced three way catalysts for abating emissions from passenger car vehicles serving the US, Asian and European market. Managed a team in the development of improved chemical catalysts for the production of nitric acid. Supervised a research team developing and commercializing new precious metal catalysts for the hydrogenation of a wide variety of organic functional groups. Was responsible for establishing a materials characterization group serving the entire worldwide company needs for catalyst and materials product.

1995-2008:

Research Fellow and Manager of Hydrogen and Fuel Cell Technology

Managed a team of scientists and engineers developing catalysts for hydrocarbon fuel processing for the generation of hydrogen and fuel cells. Team commercialized 25 new products for world wide markets.

1990-1995:

Principle Scientist of Manager of Diesel Technology

Principle Investigator of a team of 20 scientists and engineers in the development of the first monolith- diesel oxidation catalyst for heavy duty trucks, buses and light duty vehicles for the US, Asian and European market. Total revenues have exceeds \$600 million. Developed new nitric oxide catalysts and hydrocarbon traps for automobile catalytic converters

1974-1976

Research Scientist, Gulf Oil, Harmarville, PA

Catalyst development in upgrading petroleum and coal liquids to useful fuels and chemicals.

1968-1974

Research Scientist at Corning Glass Works, Corning New York

Catalyst development for base metal emission control catalysts

Recent Publications

1. Duyar, Melis, Ramachandran, Arvind, Wang, Christine, Farrauto, Robert J. "Kinetics of CO₂ methanation over Ru/Al₂O₃ and implications for renewable energy storage applications" Journal of CO₂ Utilization 12 (2015) 27-33.
2. Zheng, Qinghe, Farrauto, Robert, Deeba, Michel, Valsamakis, Ioannis, "Part 1: A comparative thermal aging study on the regenerability of Rh/Al₂O₃ and Rh/Ce_xO_y as model catalysts for automotive three way catalysts" Catalysts (2015) 5, 1770-1796
3. Zheng, Qinghe, Farrauto, Robert, Deeba, Michel, Part II: Oxidative thermal aging of Pd/Al₂O₃ and Pd/Ce_xO_y in automotive three way catalysts: The effects of fuel shutoff and attempted regeneration" Catalysts (2015) 5, 1797-1814
4. Duyar, Melis, S., Trevino, Martha Arellano, and Farrauto, Robert J. "Dual function materials for CO₂ capture and conversion using renewable H₂" Applied Catalysis B; Environmental 168 (2015) 370-376
5. Zheng, Qinghe, Janke, Christiane and Farrauto, Robert J. "Steam reforming of sulfur-containing dodecane on a Rh-Pt catalyst: influence of process parameters on catalyst stability and coke structure" Applied Catalysis B: Environmental 160-161 (2014) 525-533
6. Farrauto, R.J. "New Catalysts and Reactor Designs for the Hydrogen Economy" Chemical Engineering Journal 238 (2014) 172-177
7. Duyar, M., Farrauto, R. J., Castaldi, M. and Yegalulp, T. "Enhanced Hydrogen Generation in the Water Gas Shift Reaction" Industrial and Engineering Chemical Research, 53, (#3) 1064-1072, 2014
8. Janke, C., Duyar, M, Hoskins, M. and Farrauto, R.J. "Catalytic and adsorption studies for the Hydrogenation of CO₂ to Methane, Applied Catalysis B: Environmental" 26 June (2014) 184-191
9. Farrauto, R. J. "Low temperature oxidation of methane" Science 337 (2012) 659-660
10. Zhang, Q and Farrauto, R. "Methanol steam reforming catalyst for portable power applications" Applied Catalysis A. General (2011) 395, 64-70
11. Gruene, P, Belsova, A., Yegalulp, T. Farrauto, R. And Castaldi, M "Dispersed calcium oxide as a reversible and efficient CO₂-sorbent for intermediate temperatures. IE and C Research 50 (2011) 4042-4049

12. Eichelbaum, M., Farrauto, R. J. and Castaldi, M. "The impact of urea on the performance of metal exchanged zeolites for selective catalytic reduction of NO_x (Part I): Pyrolysis and hydrolysis of urea over zeolite catalysts" Applied Catalysis 97 (2010) Issue 1 and 2, 90-97

13. Eichelbaum, M., Farrauto, R. J. and Castaldi, M. "The impact of urea on the performance of metal exchanged zeolites for selective catalytic reduction of NO_x (PartII): Catalytic, FTIR and NMR studies" Applied Catalysis 97 (2010) Issue 1 and 2, 98-107

Total publications ~ 116, US patents 53

Awards

- 2008 Ciapetta Lectureship Award sponsored by the North /American Catalysis Society
- 2005 Catalysis and Reaction Engineering Practice Award from the American Institute of Chemical Engineers
- 2001 International Precious Metal Institute (IPMI) Award for Outstanding Contributions in the field of precious metal catalysis
- 1998 Cross Canada Lectureship Award sponsored by the Canadian Catalysis Society
- 1995 Teaching Excellence Award from the New Jersey Institute of Technology

Society Memberships

- Program Chairman for the 19th North American Catalysis Society Meeting, Philadelphia, PA 2005
- American Institute of Chemical Engineers (AIChE)
- American Chemical Society (ACS)
- International Precious Metal Institute

Plenary Lectures and from 2006-Present

- XX Reaction Engineering December 2012 "New Catalysts and Reactor designs for the Hydrogen Economy, Luxembourg
- Mitsui Keynote lectureship Award, March 2009:"Automobile Catalysis: Past, Present and Future". Tokyo, Japan
- Idecat, Porguellos, France "The Road to the Hydrogen Economy," May 2007
- Natural Gas Conversion Conference, Natal, "The Convergence of Fundamental and Applied Catalysis in Solving Industrial Problems." May 2007
- Mittasch Conference, BASF Ludwigshafen, Germany, "Advances in Environmental and Petroleum Catalysis by Engelhard" November 2006
- 13th Nordic Conference on Catalysis, Goteborg, Sweden "New Catalysts for the Hydrogen Economy" October 2008
- 50th Anniversary of the Japanese Catalysis Society "From the Internal Combustion Engine to the engine of the future: The Fuel Cell" November 2008

Books authored

Heck and Farrauto “*Catalytic Air Pollution Control: Commercial Technology*” Third edition, Wiley and Sons, Hoboken, NJ 2009

Bartholomew and Farrauto “*Fundamentals of Industrial Catalytic Processes*” Second edition, Wiley and Sons, Hoboken, NJ 2006

Farrauto, Robert J., Dorazio, L. and Bartholomew, C. “*Introduction to Catalysis and Industrial Catalytic Processes*” Wiley and Sons, Hoboken, NJ 2016

Journal Publications (1973-Present)

1. R.J. Farrauto and W.L. Haynes, Cements from glass powders, Amer. Cer. Soc. (Bull) **52**(3), 276 (1973).
2. W. Morgan and R.J. Farrauto, Active sites on a copper chromite catalyst, J. Catal. **31**, 140 (1973).
3. W. Hertl and R.J. Farrauto, Mechanism of carbon monoxide and hydrocarbon oxidation on a copper chromite catalyst, J. Catal. **29**, 352 (1973).
4. R.J. Farrauto and B. Wedding, Poisoning by SO_x of some base metal oxide auto exhaust catalysts, J. Catal. **33**, 249 (1973).
5. B. Wedding and R.J. Farrauto, Rapid evaluation of automotive exhaust oxidation catalysts with a differential scanning calorimeter, Ind. Eng. Chem. **13**, 45 (1974).
6. R.J. Farrauto, Determination and application of catalytic surface area measurements, AIChE J. **70**, 9 (1974).
7. R.J. Farrauto, Measuring catalytic surface area, Chem. Eng. Progr. **71**(1), 37 (1975).
8. R.D. Shoup, K. Hoekstra and R.J. Farrauto, Thermal stability of a copper chromite auto exhaust catalyst, Amer. Cer. Soc. (Bull) **54**(6), 576 (1975).
9. R.J. Farrauto, Adsorption studies on a nickel alumina methanation catalyst, J. Catal. **41**, 482 (1976).
10. C. Bartholomew and R.J. Farrauto, Chemistry of nickel-alumina catalysts, J. Catal. **45**, 41 (1976).
11. J. Patzer, R.J. Farrauto, and A. Montagna, Characterization of coal liquefaction catalysts using 1-methyl naphthalene as a model compound, Ind. Eng. Chem. Proc. Des. Dev. **18**, 625 (1979).

12. R. St.Amand, J. Williams and R.J. Farrauto, Application of metallorganic deposition for solar energy collectors, American Optical Society (AOS) Proc., 2nd Ann. Conf. Sept. (1979).
13. R.D. Lanam and R.J. Farrauto, Solar absorber coatings, Solar Energy Research (SERI) Proc., 2nd Ann. Conf. 1981.
14. R.J. Farrauto and M.H. Hobson, Catalyst characterization, Encyclopedia of Physical Science and Technology, Academic Press, **2**, 563 (1987).
15. R.J. Farrauto, M.H. Hobson and N. Brungard, Relationship between catalyst characterization and performance, Catalysis of Organic Reactions, Marcel Dekker, **33**, 177 (1988).
16. R.J. Farrauto, R. McClung and A.B. Stotler, Precious metals in the petrochemical industry, Proc. 12th Intern. Prec. Metals Inst., 1988, pp.13.
17. J.C. Bonacci, R.J. Farrauto, and R.M. Heck, Catalytic incineration of hazardous wastes, Library for Environ. Sci., Gulf Publishing **1**(4), 130 (1988).
18. C.H. Lee and R.J. Farrauto, Catalyst deactivation due to transient behavior in nitric acid production, Ind. Eng. Chem. Res. **28**, 1 (1989).
19. R.J. Farrauto and H.C. Lee, Ammonia oxidation catalyst with enhanced activity, Ind. Eng. Chem. Res. **29**(7), 1125 (1990).
20. D.O. Simone, T. Kennelly, N. Brungard, and R.J. Farrauto, Reversible poisoning of palladium catalysts for combustion of methane, Appl. Catal. **70**, 87, (1987).
21. R.J. Farrauto, t. Kennelly, E. Waterman and M.H. Hobson, The catalytic chemistry of supported palladium for combustion of methane, Appl. Catal. **81**(2), 227 (1992).
22. J. Chen, R.M. Heck and R.J. Farrauto, Deactivation, regeneration and poison resistant commercial catalysts, Catal. Today **11**, 517-545 (1992).
23. R.J. Farrauto and J.J. Mooney, Reducing truck diesel emissions, Automotive Eng. **100** (2) 19 (1992).
24. R.J. Farrauto and J.J. Mooney, Effects of sulfur on catalytic diesel oxidation performance, SAE. 920557, Feb. (1992).
25. R.M.Heck, R.J. Farrauto and H.C. Lee, Ozone abatement in commercial aircraft, Catal.Today, **13**, 43-58 (1992).
26. S. Kovenklioglu, Z. Coa, D. Shah, R.J.Farrauto and E.Balko, Direct hydrodechlorination of toxic organics in waste water, AIChE J. **38**(7), 1003 (1992).

27. T. Yu, H. Shaw and R.J. Farrauto, Catalytic oxidation of trichloroethylene over PdO catalyst on gamma-alumina, Am. Chem. Soc. Symp. Ser. 495, Catalytic Control of Air Pollution, chap. 11, (1992).
28. Y. Wang, H. Shaw and R.J. Farrauto, Catalytic oxidation of trace concentrations of trichloroethylene over 1.5% Pt on gamma-alumina, Am. Chem. Soc. Symp. Ser. 495, Catalytic Control of Air Pollution, chap 10 (1992).
29. R.J. Farrauto and R.M. Heck, Precious metals in industry, Encyclopedia of Chemical Processing and Design, 1992.
30. R.J. Farrauto, R.M. Heck and B.K. Speronello, Catalysts and the environment, Chem. Eng. News, Sept. 7, 1992, p. 34.
31. R.J. Farrauto, K.E. Voss and R.M. Heck, A base metal oxide catalyst for reduction of diesel particulates, SAE 932720, Oct. 1992.
32. K.E. Voss, B. Yavuz, C. Hirt, and R.J. Farrauto, Performance characteristics of a novel diesel oxidation catalyst, SAE. 940239, Feb. 1994.
33. K.E. Voss, J. Lampert, R.J. Farrauto, G. Rice, and A. Punke, Catalytic oxidation of diesel particulates with base metal oxides, Catalysts for Air Pollution control 3 (CAPOC3), April, 1994.
34. R.J. Farrauto and R.M. Heck, Precious metals use in environmental catalysis, Intern. Precious. Metals Inst., June 1993.
35. R.M. Heck and R.J. Farrauto, Catalytic Air Pollution control: Commercial technology, Van Nostrand Reinhold, (1st edition, New York, 1994).
36. R.J. Farrauto, M. Larkin, J. Fu and J. Feeley, Catalytic combustion for ultra-low emissions, Mat. Res. Soc. Symp. Proc. **344**, 101 (1994).
37. V. Bell, J. Feeley, M. Deeba and R.J. Farrauto, In-situ high temperature studies of NO_x reduction with propylene over Cu/ZSM-5 catalysts, Catal. Lett. **29**, 15 (1994).
38. M. Deeba, R.J. Farrauto and Y.K. Lui, stabilization of Pt on SiO₂ promoted with lanthanum oxide and zirconium oxide, Appl. Catal. A, Gen.: **124**, 339 (1995).
39. J. Feeley, M. Deeba, R.J. Farrauto, G. Beri, and A. Haynes, Lean NO_x reduction with hydrocarbons over Ga/S-ZrO_x and S-GaZr/Zeolite catalyts, Appl. Catal. B, Environ., **6**, 79 (1995).
40. R.J. Farrauto, J. Lampert, M. Hobson, and E. Waterman, Thermal decomposition and reformation of Pd catalysts, support effects, Appl. Catal. B, Environ., **6**, 263 (1995).

41. J. Feeley, M. Deeba and R.J. Farrauto, Abatement of NO_x from diesel engines: Status and technical challenges, SAE 950747 (1995).
42. M. Deeba, J. Feeley, R.J. Farrauto, N. Steinbock and A. Punke, Catalytic abatement of NO_x from diesel engines: Development of four way catalysts, SAE. 952491 (1995).
43. R.M. Heck and R.J. Farrauto, Automotive emission control: Present and future challenges, Autom. Eng. Feb. 1996.
44. R.J. Farrauto and K. Voss, Monolithic diesel oxidation catalyst, Appl. Catal. B, Environ., **10**, 29 (1996).
45. M. Amiridis, T. Hang and R.J. Farrauto, A review of the selective catalytic reduction of nitric oxide by hydrocarbons, Appl. Catal. B, Environ., **10**, 203 (1996).
46. R.J. Farrauto, New applications in monolithic supported catalysts, React. Kin. Catal. Lett. **60**(2),233 (1997).
47. R.M. Heck and R.J. Farrauto, The automobile catalyst, Cat. Tech. **1**, 117 (1997).
48. J. Lampert, S. Kazi and R.J. Farrauto, Pd catalyst performance for methane emissions abatement from lean burn natural gas engines, Appl. Catal. B, Environ., **14**, 211-223 (1997).
49. R.M. Heck, R.J. Farrauto and M. Durilla, "Employing metal catalysts for VOC Emission control" Pollution Engineering **30**, Apr. 52 (1998).
50. R.M. Heck and R.J. Farrauto, Catalysis : Role of mass transfer and adsorption, Chemical Processing 61/No.11 (1998) 55
51. J. Feeley, M. Deeba and R.J. Farrauto, A catalytic NO_x management system for lean burn engines, Stud. Surf. Sci. Catal., Catalysis and Automotive Pollution Control IV, **116**, 529 (1998).
52. R.M. Heck and R.J. Farrauto, Air pollution control – catalytic, Encyclopedia of Environmental Analysis and Remediation (ed. R.A. Meyers) Wiley, 1998, p. 213.
53. R.J. Farrauto and R.M. Heck, Catalytic converters: state of the art and perspectives, Catal. Today **51**, 351 (1999).
54. R.J. Farrauto and R.M. Heck, Environmental catalysis into the 21st century, Catal. Today **55**, 179 (2000).
55. R.J. Farrauto, The generation of hydrogen for the solid polymer membrane fuel cell, Comptes Rendus de l'Acad. Sci. Paris, Serie IIc, Chemie, 3 (2000).

56. O. Korotkikh and R.J. Farrauto, Selective oxidation of CO in the presence of hydrogen fuel cell applications, *Catal. Today* 62 (2000) 249.
57. Ronald M. Heck, Robert J. Farrauto and S. Gulati “ The application of monoliths for gas phase reactions” *Chemical Engineering Journal*, 82 (2001) 149
58. Xinsheng Liu, J. Lampert, D. Arendarskii and Robert J. Farrauto, “FT-IR Spectroscopic studies of hydrocarbon trapping in Ag/ZSM-5 for gasoline engines under cold start conditions” *Applied Catalysis B: Environmental* 35 (2001) 125
59. R.M. Heck and R.J. Farrauto, Auto exhaust catalysis, *Appl. Catal. A*, 221. (2001) 443
60. R.M. Heck, R.J. Farrauto and S. Gulati, The application of monoliths for gas phase reactions, *Chem. Eng. J.* 82 (2001) 149
61. Xinsheng Liu, Olga Korotkikh and Robert J. Farrauto, “Structural study of the selective catalytic oxidation of CO in hydrogen” in print *Applied Catalysis A: General* 226 (2002) 293-303
62. Shore, L. and Farrauto, R “ PROX Catalysts for selective oxidation of CO for fuel cell applications” *Encyclopedia of Fuel Cells*, Wiley and Sons, 2002
63. Heck, R., Farrauto, R with Gulati, S “Catalytic Air Pollution Control: Commercial Technology” second edition, Wiley and Sons, NY 2002
64. Farrauto, R., Hwang, H. Ruettinger, W., Shore, L. Giroux, T., Liu, Y. and Ilinich, O. *Annual Review of Materials Science*, “New Material Needs for Hydrocarbon Fuel Processing : Generating Hydrogen for the PEM Fuel Cell” 33: 1-27 (2003)
65. Farrauto, R. “From the internal combustion engine to the fuel cell: moving towards the hydrogen economy, *Science and technology in catalysis for 2002* Kodansha Elsevier, Tokyo, 2003: 21-38.
66. Farrauto, R. J. “Catalysts for Automobile Pollution Control, the State-of-the-art and Engine of the Future. Society of Automotive Engineering India 2003.
67. Ruettinger, W., Ilinich, O., Farrauto, R. J. “ A new generation of water gas shift catalysts for fuel cell applications” *Journal of Power Sources* 118 (2003) 61
68. Koryabkina, N., Phatak, A., Ruettinger, W., Farrauto, R., Ribeiro, F. 2003. “Determination of kinetic parameters for water-gas shift reactions on copper catalysts under realistic conditions for fuel cell applications,” *J. Catal.* 217: 233.
69. Novochinskii, I, Song, C, Ma, X., Liu, X, Shore, L, Lampert, J. and Farrauto, R “ Low-temperature H₂S removal from steam-containing gas mixtures with ZnO for fuel cell applications. 2. Washcoated monolith. *Energy and Fuels* 2004, 18, 584-589

70. Novochinskii, I, Song, C, Ma, X., Liu, X, Shore, L, Lampert, J. and Farrauto, R “ Low-temperature H₂S removal from steam-containing gas mixtures with ZnO for fuel cell applications. 1 ZnO particles and extrudates” *Energy and Fuels* 2004, 18, 576-583.
71. Liu, X, Ruettinger, W and Farrauto, R. “Deactivation of Pt/CeO₂ water gas shift catalysts during strat operation” *Applied Catalysis B: Environmental*, 56 (2005) 69
72. Farrauto, R. J. “Introduction to solid polymer membrane fuel cells and reforming natural gas for the production of hydrogen” *Applied Catalysis B: Environmental*, 56 (2005) 3
73. Farrauto, R.J. “Industrial Catalysis: A practical Guide” Chapter in Riegels Handbook (11th edition), Kluwer Publishers, Amsterdam, the Netherlands 2005. In Press
74. Bartholomew, C and Farrauto, R.J. “Fundamentals of Industrial Catalytic Processes” Wiley and sons, second edition, New York 2006
75. Ruettinger, W., Liu, X and Farrauto, R. J. “Mechanism of aging of Pt/CeO₂/ZrO₂ water gas shift catalysts” *Applied Catalysis B: Environmental* 2006, 65 (1 and 2) 135
76. Farrauto, R. Liu, Y, Ruettinger, W. Ilinich, O. Giroux, T. “Precious Metal Monoliths for natural Gas Reforming” *Catalysis Reviews*, 49, 411 (2007) .
77. Ilinich, O., Liu, X, Reuttinger and Farrauto, R. “Deactivation mechanism of a new water gas shift catalyst “ *J.Catalysis* 247 (2007) 112
78. Ruettinger, W., Liu, X., Xu, X and Farrauto, R. “Effect of Molybdenum and Rhenium promoters on the activity and stability of a Pt on ZrO₂ WGS catalyst (Part 1)” *Topic in Catalysis* November 2008.
79. Dorazio, L., Ruettinger, W., Castaldi, M. and Farrauto, R. “Deactivation, regeneration and stable performance of a Pt, Mo, Re WGS catalyst for on-site hydrogen generation” *Topics in Catalysis*, November 2008 (Part 2)
80. 85 Alerasool, S., Kelkar, C. and Farrauto, R.J. “Rational Design Strategies for Industrial Catalysis” in *Design of Heterogeneous Catalysis*, 83-110, edited by Umit Ozkan, Wiley-VCH, Weinheim, 2009
81. Farrauto, R. and Hoke, J. *Automotive Emission Control: past. present and future Handbook of Green Chemistry: Green Catalysis*, Edited by Paul Anastas, Vol 2, Chapter 9, 197-220. Wiley-VCH, Weinheim, Germany
82. Farrauto, R. “ Building the Hydrogen Infrastructure for the Hydrogen Economy” *Hydrocarbon Engineering*, in press

83. Simson, A. Castaldi, M. and Farrauto, R. "Kinetic and process study for ethanol reforming using a Rh/Pt washcoated monolith catalyst" *Applied Catalyst B: Environmental*, 89 (2009) 58-64
84. Heck, R. and Farrauto, R. J. with Gulati, S. *Catalytic Air Pollution Control: Commercial Technology* 3rd edition, Wiley and Sons, Hoboken, NJ 2009
85. Kohn, M., Castaldi, M. and Farrauto, R. "ATR and dry reforming of landfill gas over a Rh/Al₂O₃ monolith catalyst" *APCAT B: Environmental* 94 (2010) 125
86. Eigelbaum, M, Farrauto, R. Castaldi, M. The impact of urea on the performance of metal exchanged zeolites for the selective catalytic reduction of NO_x: Part I. Pyrolysis and hydrolysis of urea over zeolite catalysts, *Applied Catalysis* 97 (2010) Issues 1-2, 90-97
87. Eigelbaum, M, Castaldi, M. and Farrauto, R.J "The Impact of Urea on the Performance of Metal Exchanged Zeolites for the Selective Catalytic Reduction of NO_x - Part II. Catalytic, FTIR, and NMR Studies, *Applied Catalysis* 97 (2010) Issues 1-2, 98-107
88. Dorazio, L, Ruettinger, W. Castaldi, M and Farrauto, R. J. "Deactivation, Regeneration and Stable Performance of a Pt,Mo,Re Water Gas Shift Catalyst for on-sight H₂ Generation" *Topics in Catalysis* 51 (2008) (No. 1-4) 58-64
89. Ruettinger, W. Liu, X., Yu, X. and Farrauto, R. J. "Effect of Mo and Re Promoters on the Activity and stability of a Pt/ZrO₂ water Gas Shift Catalyst" *Topics in Catalysis* 51 (2008) (No1-4) 60-67
90. Gruene, P, Belsova, A., Yegalup, T. Farrauto, R. And Castaldi, M "Dispersed calcium oxide as a reversible and efficient CO₂-sorbent for intermediate temperatures. *IE and C Research* 50 (2011) 4042-4049
91. Zhang, Q and Farrauto, R. "Methanol steam reforming catalyst for portable power applications" *Applied Catalysis A. General* 395 (2011) 64-70
92. R. Farrauto, A. Schaefer, E. Schwab, H. Urtel "Hydrocarbon Reforming Catalysts and New Reactor Designs for Compact Hydrogen Generators" *Oil and Gas European Magazine* 2011,
- 93/Simson, A. Farrauto, R. and Castaldi, M "Catalyst deactivation and regeneration reforming ethanol/gasoline blends containing sulfur" *Applied Catalysis B Environmental* 106 (2011) 295-303
94. Wade, J. and Farrauto, R. "Emission Control: Mobile and Stationary" in "Handbook of Metropolitan Sustainability" edited by Frank Zeman, Woodhead Publishing, London, 2012, pp. 260-312.

95. Tran, P. Chen, J and Farrauto, R “VOC Industrial Applications” in Oxidation Catalysis, edited Daniel Duprex, Fabrizio Cavani, Imperial College Press, London 2014.
96. Farrauto, R. “ Industrial Catalysis: A Practical Guide” Handbook of Industrial Chemistry and Biotechnology, ed. James Kent, Vol. 1, 12th edition, page 201-230, Springer, NY 2012
97. Manganaro, J. Chen, B., Adeosun, J., Lakhapatri, S., Favetta, D., Lawal, A, Farrauto, R. Droazio. L. and Rosse, D. “Conversion of Residual Biomass into liquid Transportation Fuel: An Energy Analysis” Energy and Fuels (2011) 25, 2711-2720
98. Hochmuth, J. Wassermann, K. and Farrauto, R. J.” Car Cleaning Catalysts” Handbook of Comprehensive Inorganic Chemistry, Elsevier Vol 7, 26 November 2012
- 99.. Zhang, Q, Shore, L. and Farrauto, R.J. “Selective oxidation of CO in H₂ with a Cu, Fe, Pt monolith catalyst” International Journal of Hydrogen 37 (#14) July 2012 10874-10880
100. Ilinich, O, Liu, Y and Farrauto, R.J. “Kinetics of methanol steam reforming catalyst” Industrial and Engineering Chemical Research 52 (2013)638-644
101. Zhang, X. and Farrauto “Methanol steam reforming catalyst for portable power applications” Applied Catalysis A: General 395 (2011) 64102.
102. Farrauto, Robert J. “Low temperature oxidation of methane” Science 337 (2012) 659
103. Laval, A. and Farrauto, R. J. New and Future Developments in Catalysis: Remediation and New fuels “The Convergence of Emission Control and Source of Clean Energy Chapter 8, Elsevier 2013.
104. Liu, Y., Farrauto, R. J. and Lawal, A “ ATR of glycerol” Chem. Engr. Science, 89, Feb 2012, 31
105. Farrauto, R.J. “New Catalysts and Reactor Designs for the Hydrogen Economy” Chemical Engineering Journal 238 (2014) 172-177
- 106 Zhang, Q. and Farrauto, R. J. “Methanol Steam Reforming for Portable Power Fuel Cell Applications” APACAT A: General 395 (2011)640-670
107. Kohn, M., Farrauto, R. and Castaldi, M. “ ATR and dry reforming of landfill gas using Rh/Al₂O₃” Applied Catalysis: B. Environmental; 144 (2014) 353
108. Simson, A., Farrauto, R.J. “The use of niobium in oxygen storage components for TWC, Applied Catalysis B: Environmental”
109. Duyar, M., Farrauto, R. J., Castaldi, M. and Yegalulp, T. “Enhanced Hydrogen Generation in the Water Gas Shift Reaction” Industrial and Engineering Chemical Research, 53, (#3) 1064-1072, 2014

110. Janke, C., Duyar, M, Hoskins, M. and Farrauto, R.J. “Catalytic and adsorption studies for the Hydrogenation of CO₂ to Methane , Applied Catalysis B: Environmental” 26 June (2014) 184-191

112. Zheng, Q, Janke, C. and Farrauto, R.J “Steam reforming of sulfur containing dodecane on a Rh-Pt catalyst: Influence of process parameters on catalyst stability and coke structure” Applied Catalysis B: Environmental 160-161 (2014) 525-533

113. Duyar, M. Arellano, M. and Farrauto R. J. “Dual function material for the simultaneous capture and conversion of CO₂ using renewable hydrogen” Applied Catalysis B: Environmental

114. Duyar, Melis, Ramachandran, Arvind, Wang, Christine, Farrauto, Robert J. “Kinetics of CO₂ methanation over Ru/Al₂O₃ and implications for renewable energy storage applications” Journal of CO₂ Utilization 12 (2015) 27-33.

115, Zheng, Qinghe, Farrauto, Robert, Deeba, Michel, Valsamakis, Ioannis, “Part 1: A comparative thermal aging study on the regenerability of Rh/Al₂O₃ and Rh/Ce_xO_y as model catalysts for automotive three way catalysts” Catalysts (2015) 5, 1770-1796

116. Zheng, Qinghe, Farrauto, Robert, Deeba, Michel, Part II: Oxidative thermal aging of Pd/Al₂O₃ and Pd/Ce_xO_y in automotive three way catalysts: The effects of fuel shutoff and attempted regeneration” Catalysts (2015) 5, 1797-1814

US Patents (1972-Present)

1. US 3,743,525 Hydraulic cements from glass powders, R.J. Farrauto and W.L. Haynes.
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3. US 3,870,658 Copper chromite / alumina catalyst having high temperature stability, R.J. Farrauto, K.Hoekstra, and R.D. Shoup.
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