
# Moises A. Carreon

Fryrear Chair for Innovation and Excellence, Professor

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## Professional Preparation

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| U.M.S.N.H. Mexico | Chemical Engineering | B.S. | 1997 |
| U.M.S.N.H. Mexico | Materials Science Engineering | M.S. | 1999 |
| University of Cincinnati | Chemical& Materials Engineering | Ph.D. | 2003 |
| University of Toronto | Chemistry | Postdoc | 2004-2005 |

## Appointments

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| 4/20- | Professor, Chemical&Biological Engineering Dept. Colorado School of Mines |
| 1/14- 3/20 | Associate Professor, Chemical&Biological Engineering Dept. Colorado School of Mines |
| 6/13- 12/13 | Associate Professor, Chemical Engineering Dept. University of Louisville. |
| 7/07 -5/13 | Assistant Professor, Chemical Engineering Dept. University of Louisville. |
| 1/06-6/07 | Research Associate, Chemical Engineering & Biological Engineering Department, University of Colorado. |
| 9/03-8/04 | Assistant Professor, Materials Science Engineering, Materials Research Institute, University of Michoacan, Mexico. |

## Awards and Recognitions as Independent Researcher

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| 2021 | Ben Fryrear Chair for Excellence and Innovation |
| 2018 | *Doctorate Honoris Causa*. Universidad Michoacana (UMSNH), Morelia, Mexico |
| 2018 | Early Career Scholar in Materials Science. Journal of Materials Research. |
| 2017 | List of 10 successful mexican personalities in the USA. Magazine “Hola”. |
| 2014 | Innovator Award. Society of Hispanic Professional Engineers |
| 2014 | List of 12 extraordinary personalities that moved Mexico in 2014.Mexico News Network http://www.mexiconewsnetwork.com/news/mexican-personalities-2014/ |
| 2014 | National Academy of Engineers Frontiers of Engineering Symposium invitee |
| 2014 | List of 50 personalities who transform Mexico. Magazine “Quien”. |
| 2013 | **PECASE (Presidential Early Career Award for Scientists and Engineers)** |
| 2013 | AIChE Separations Division Kunesh Award |
| 2011 | NSF CAREER AWARD |
| 2010 | Carl Storm Minority Fellowship. Gordon Conference on membranes |
| 2010 | NAMS Travel Award . North American Membrane Society Meeting. |
| 2009 | ACS-PRF Doctoral New Investigator award. |

## Awards as Postdoc and Graduate Student

2008 NSF Fellowship to attend Summer Institute course at Northwestern University
2007 American Institute of Chemists Postdoctoral Award. University of Colorado.
2003 Outstanding Graduate Student in Research Award. University of Cincinnati.
2003 Kokes Award, 18th North American Catalysis Society Meeting. Cancun, Mexico.
2002 Graduate Research Summer Award. University of Cincinnati.
2001 Kokes Award. 17th North American Catalysis Society Meeting. Toronto, Canada.

## Research Themes

My research interest focus on the rational design of advanced functional porous crystals at different length scales, including zeolites, mixed metal oxides, metal organic frameworks, and porous organic cages for applications in molecular gas separations, gas storage, and heterogeneous catalysis. We aim to have a fundamental understanding of the formation mechanisms of these materials and to establish its basic structure/performance relationships. Our research tackles highly relevant societal issues related to energy and environment, including -but not limited- to carbon dioxide capture and utilization, biomass conversion to liquid fuels, natural gas purification and storage, spent nuclear fuel treatment, ammonia synthesis and separation. Our research is both of fundamental and functional (application) nature.

## List of Refereed Publications (101)

101) J.M. Crawford, J.B. Jasinski, M.A. Carreon* "Towards continuous deoxygenation of acetic acid catalyzed by recyclable mono/bi/trimetallic zeolite catalysts", ***Journal of Catalysis* 2021**, *in press* https://doi.org/10.1016/j.jcat.2021.07.018
100) J.M. Lucero, J.M. Crawford, C.A. Wolden, M.A. Carreon*, "Tunability of ammonia adsorption over NaP zeolite", ***Microporous and Mesoporous Materials* 2021**, 111288.
99) S.Denning, A.A.A. Majid, J.M. Lucero, J.M. Crawford, M.A. Carreon*, C.A. Koh, "Methane Hydrate Growth Promoted by Microporous Zeolitic Imidazolate Frameworks ZIF-8 and ZIF-67 for Enhanced Methane Storage", ***ACS Sustainable Chemistry & Engineering* 2021**, 9, 27, 9001–9010.
98) F. Gorky, J. M. Lucero, J.M. Crawford, B. Blake, M.A. Carreon, M.L. Carreon "Plasma-Induced Catalytic Conversion of Nitrogen and Hydrogen to Ammonia over Zeolitic Imidazolate Frameworks ZIF-8 and ZIF-67", ***ACS Applied Materials & Interfaces* 2021**, 13, 18, 21338–21348
97) F. Gorky, S.R. Guthrie, C.S. Smoljan, J.M. Crawford, M.A. Carreon, M.L. Carreon, "Plasma ammonia synthesis over mesoporous silica SBA-15", ***Journal of Physics D: Applied Physics* 2021**, 54, 26, 264003.
96) F.Gorky, J.M.Lucero, J.M. Crawford, B. Blake, S. Guthrie, M. A. Carreon, M. L Carreon, "Insights on the Cold Plasma Ammonia Synthesis and Decomposition using alkaline earth metal-based perovskites", ***Catalysis Science & Technology* 2021**, *in press*, https://doi.org/10.1039/D1CY00729G
95) Q. Wei, J. M.Lucero, J.M.Crawford, J. D.Way, C. A.Wolden, M. A.Carreon*, "Ammonia separation from $N_2$ and $H_2$ over LTA zeolitic imidazolate framework membranes**" *Journal of Membrane Science* 2021,** 623, 119078.
94) C.A. Dunn, S. Denning, J.M. Crawford, R. Zhou, G.E. Dwulet, M.A. Carreon, D.L. Gin, R.D. Noble, "$CO_2/CH_4$ separation characteristics of poly (RTIL)-RTIL-zeolite mixed-matrix membranes evaluated under binary feeds up to 40 bar and 50° C" ***Journal of Membrane Science* 2021**, 621, 118979.
93) K. Kian, S. Liguori, H. Pilorgé, J. M.Crawford, M. A.Carreon, J. L.Martin, R. L.Grimm, J. Wilcox, "Prospects of $CO_2$ Capture via 13X for Low-Carbon Hydrogen Production using a Pd-based Metallic Membrane Reactor" ***Chemical Engineering Journal* 2021**, 407, 127224.

92) S. Denning, A.A.A. Majid, J. M. Lucero, J. M. Crawford, M.A. Carreon*, C. A. Koh "Metal Organic Framework HKUST-1 Promotes Methane Hydrate Formation for Improved Gas Storage Capacity" ***ACS Applied Materials & Interfaces*** **2020**, 12 (47), 53510-53518.
91) J. M. Crawford, R. Anderson, R. Gasvoda, N. Kovach, C. Smoljan, J. B Jasinski, B. G. Trewyn, S. Agarwal, D. A Gómez-Gualdrón, M. A. Carreon* "Vacancy healing as a desorption tool: Oxygen triggered removal of stored ammonia from NiO1-x/MOR validated by experiments and simulations" ***ACS Applied Energy Materials*** **2020**, 3, 9, 8233–8239.
90) J. M. Lucero, M.A. Carreon*, "Separation of Light Gases from Xenon over Porous Organic Cage Membranes" ***ACS Applied Materials & Interfaces*** **2020**, 12, 28, 32182–32188.
89) F. Gorky, M.A. Carreon; M.L. Carreon, "Experimental strategies to increase ammonia yield in plasma catalysis over LTA and BEA zeolites", ***IOP SciNotes*** **2020**, 1, 024801.
88) C.S. Smoljan, J.M. Crawford, M.A. Carreon*, "Mesoporous microspherical NiO catalysts for the deoxygenation of oleic acid", ***Catalysis Communications*** **2020**, 143, 106046.
87) M.A. Carreon* Porous crystals as membranes, ***Science*** **2020,** 367, 6478, 624-625.
86) J. Lucero, T. Self, , M.A. Carreon*, Synthesis of ZIF-11 Crystals by Microwave Heating, ***New Journal of Chemistry*** **2020**, 44, 3537-3545.
85) J.R. Shah, F. Gorky, J. Lucero, M.A. Carreon, M.L. Carreon, Ammonia synthesis via atmospheric plasma-catalysis: Zeolite 5A a case of study, ***Industrial & Engineering Chemistry Research*** **2020**, 59 (11), 5167-5176.
84) J. M. Lucero, J. B. Jasinski, M. Song, D. Li, L. Liu, J. Liu, J. De Yoreo, P. K. Thallapally, M. A. Carreon*, Synthesis of Porous Organic Cage CC3 via Solvent Modulated Evaporation, ***Inorganica Chimica Acta*** **2020**, 501, 119312.
83) J.M. Crawford, S. F. Zaccarine, N. C. Kovach, C.S. Smoljan, J. Lucero ; B. G. Trewyn, S. Pylypenko, M. A. Carreon*, Decarboxylation of stearic acid over Ni/MOR catalysts, ***Journal of Chemical Technology & Biotechnology*** **2020,** 95, 102-110.
82) R. Anderson, B. Seong, Z. Peterson, M. Stevanak, M. A. Carreon, D. A. Gómez-Gualdrón, Exploiting hydrophobicity and hydrophilicity in nanopores as a design principle for "smart" MOF microtanks for methane storage, ***Molecular Systems Design & Engineering*** **2020**, 5, 166-176.
81) S. Denning, J. Lucero, C.A. Koh, M.A. Carreon* Chabazite zeolite SAPO-34 membranes for He/$CH_4$ separation, ***ACS Materials Letters*** **2019**, 1, 655-659.
80) J. Lucero, J.M. Crawford, C. Osuna, M.A. Carreon*, Solvothermal synthesis of porous organic cage CC3 in the presence of dimethylformamide as solvent, ***CrystEngComm*** **2019**, 21, 34, 5039-5044.
79) J. Lucero, C. Osuna, J.M. Crawford, M.A. Carreon*, Microwave Assisted Synthesis of Porous Organic Cages CC3 and CC2, ***CrystEngComm*** **2019**, 21, 4534-4537.
78) T. Wu, J. Lucero, J.M. Crawford, M.A. Sinnwell, P.K. Thallapally, M.A. Carreon* SAPO-34 Membranes for Xenon Capture from Air, ***Journal of Membrane Science*** **2019,** 573, 288-292.
77) J Crawford, C Smoljan, J Lucero, M.A. Carreon* Deoxygenation of Stearic Acid over Cobalt-Based NaX Zeolite, ***Catalysts*** **2019,** 9, 1, 42.
76) J. Shah, T. Wu, J. Lucero, M.A. Carreon, M. L. Carreon, Non-thermal Plasma Synthesis of Ammonia over Ni-MOF-74, ***ACS Sustainable Chemistry & Engineering*** **2019**, 7 (1), 377-383.
75) J. E. Romo, T. Wu, X. Huang, J. Lucero, J. L. Irwin, J. Q. Bond, M. A. Carreon, S.G. Wettstein, SAPO-34/5A Zeolite Bead Catalysts for Furan Production from Xylose and Glucose, ***ACS Omega*** **2018**, 3, 11, 16253-16259.
74) J. M. Crawford, M.A. Carreon*, Decarboxylation of Diunsaturated Linoleic Acid to Heptadecane over Zeolite Supported Pt/ZIF-67 Catalysts, ***Industrial & Engineering Chemistry Research*** **2018,** 57 (47), 15991–15997.
73) T. Wu, J. Lucero, M.A. Sinnwell, P.K. Thallapally, M.A. Carreon* Recovery of Xenon from air over ZIF-8 membranes, ***Chemical Communications*** **2018**, 54, 8976-8979.
72) P. Warrier, M. Naveed Khan, M.A. Carreon, C.J. Peters, C.A. Koh, "Integrated gas hydrate-membrane system for natural gas purification" ***Journal of Renewable and Sustainable Energy*** **2018,** 10, 3, 034701

71) J. Lucero, S.K. Elsaidi, R. Anderson, T. Wu, D. Gomez Gualdron, P.K. Thallapally, M.A. Carreon*, "Time Dependent Structural Evolution of Porous Organic Cage CC3", ***Crystal Growth & Design*** **2018**, 18, 2, 921-927.

70) T. Wu, J. Lucero, Z. Zong, S.K. Elsaidi, P.K. Thallapally, M.A. Carreon*, "Microporous crystalline membranes for Kr/Xe Separation: Comparison between AlPO-18, SAPO-34, and ZIF-8", ***ACS Applied Nano Materials*** **2018,** 1, 463-470.

69) R. Anderson, B. Schweitzer, T. Wu, M.A. Carreon, D. Gomez-Gualdron, "Molecular simulation insights on Xe/Kr separation in a set of nanoporous crystalline membranes" ***ACS Applied Materials & Interfaces*** **2018,** 10, 582-592.

68) M.A. Carreon* Molecular Sieve Membranes for $N_2/CH_4$ Separation, ***Journal of Materials Research*** **2018**, 33, 32-43.

67) L. Yang, M.A. Carreon*, Deoxygenation of palmitic and lauric acids over Pt/ZIF-67 membrane/zeolite 5A bead catalysts ***ACS Applied Materials & Interfaces*** **2017,** 9, 31993-32000.

66) L. Yang, B. McNichols, B. Schweitzer, D. Gomez-Gualdron, B. G. Trewyn, A. Sellinger, M. A. Carreon*, Noble metal-free catalytic decarboxylation of oleic acid to n-heptadecane on nickel-based metal-organic frameworks (MOFs), ***Catalysis Science and Technology*** **2017**, 7, 3027-3035.

65) Z. Zong, S.K. Elsaidi, P.K. Thallapally, M.A. Carreon*, Highly permeable AlPO-18 membranes for $N_2/CH_4$ separation, ***Industrial & Engineering Chemistry Research*** **2017**, 56 , 4113–4118.

64) T. Wu, X. Feng, M. L. Carreon, M. A. Carreon*, "Synthesis of SAPO-56 with controlled crystal size", ***Journal of Nanoparticle Research*** **2017**, 19, 93, 1-8.

63) T. Wu, X. Feng, S. K. Elsaidi, P.K. Thallapally, M. A. Carreon*, Zeolitic Imidazolate Framework-8 (ZIF-8) membranes for Kr/Xe separation, ***Industrial & Engineering Chemistry Research*** **2017**, 56, 1682–1686.

62) Z. Zong, M.A. Carreon*, Thin SAPO-34 Membranes Synthesized in Stainless Steel Autoclaves for $N_2/CH_4$ Separation, ***Journal of Membrane Science*** **2017,** 524, 117-123.

61) L. Yang, M.A. Carreon*, Effect of Reaction Parameters on the Decarboxylation of Oleic Acid over Pt/ZIF-67membrane/zeolite 5A bead catalysts, ***Journal of Chemical Technology & Biotechnology*** **2017,** 92, 52-58.

60) K.L. Tate, S. Li, M. Yu, M.A. Carreon*, Zeolite adsorbent- MOF layered nanovalves for $CH_4$ storage, ***Adsorption*** **2017**, 23, 19-24.

59) X. Feng, T. Wu, M.A Carreon*, Synthesis of ZIF-67 and ZIF-8 crystals using DMSO (Dimethyl Sulfoxide) as solvent and kinetic transformation studies, ***Journal of Crystal Growth*** **2016**, 455, 152-156

58) X. Feng, Z. Zong, S. K. Elsaidi, J. B. Jasinski, R. Krishna, P.K. Thallapally, M. A. Carreon*, "Kr/Xe Separation over a Chabazite Zeolite Membrane" ***Journal of the American Chemical Society*** **2016**, 138, 31,9791–9794.

57) Z. Song, A. Nambo, K. L. Tate, A. Bao, M. Zhu, J. B. Jasinski, S. J. Zhou, H. S. Meyer, M. A. Carreon*, S. Li, M. Yu,"Nanovalved adsorbents for $CH_4$ storage" ***Nano Letters*** **2016**, 16,5, 3309–3313

56) Z. Xie, Z. He, X. Feng, W. Xu, X. Cui, J. Zhang, C. Yan, M. A. Carreon, Z. Liu, Y. Wang, "Hierarchical Sandwich-Like Structure of Ultrafine N-Rich Porous Carbon Nanospheres Grown on Graphene Sheets as Superior Lithium-Ion Battery Anodes" ***ACS Applied Materials & Interfaces*** **2016**, 8, 16, 10324–10333.

55) M. J. Valero-Pedraza, V. Gascón, M. A. Carreon, F. Leardini, J. R. Ares, A. Martín, M. Sánchez-Sánchez, M. A. Bañares, "Operando Raman-mass spectrometry investigation of hydrogen release by thermolysis of ammonia borane confined in mesoporous materials " ***Microporous and Mesoporous Materials*** **2016**, 226, 454-465.

54) S. M. Bruce, Z. Zong, A. Chatzidimitriou, L. E. Avci, J. Q. Bond, M. A. Carreon, S. G. Wettstein "Small pore zeolite catalysts for furfural synthesis from xylose and switchgrass in a γ-valerolactone/water solvent" ***Journal of Molecular Catalysis A: Chemical*** **2016,** 422, 18-22.

53) Z. Zong, X. Feng, Y. Huang, Z. Song, R. Zhou, S.J. Zhou, M.A. Carreon*, M. Yu, S. Li, Highly permeable $N_2/CH_4$ separation SAPO-34 membranes synthesized by diluted gels and increased crystallization temperature, ***Microporous and Mesoporous Materials*** **2016**, 224, 36-42.

52) M.C. Duke, B. Zhu, C.M. Doherty, M.R. Hill, A.J. Hill, M.A. Carreon, "Structural effects on SAPO-34 and ZIF-8 materials exposed to seawater solutions, and their potential as desalination membranes", ***Desalination* 2016**, 377, 128-137.

51) L. Yang, K. Tate, J.B. Jasinski, M.A. Carreon*, " Decarboxylation of oleic acid to heptadecane over Pt-supported zeolite 5A beads", ***ACS Catalysis* 2015**, 5, 6497-6502.

50) S.R. Venna, M.A.Carreon* Metal organic framework membranes for carbon dioxide separation, ***Chemical Engineering Science* 2015**, 124, 3-19.

49) S. Li, Z. Zong, S.J. Zhou, Y. Huang, Z. Song, X. Feng, R. Zhou, H. S. Meyer, M. Yu, M. A. Carreon* , SAPO-34 Membranes for $N_2/CH_4$ Separation: Preparation, Characterization, Separation Performance and Economic Evaluation, ***Journal of Membrane Science* 2015**, 487, 141.

48) M. Ahmadi, A. Nambo, J. B. Jasinski, P. Ratnasamy, M. A. Carreon*, "Decarboxylation of oleic acid over Pt catalysts supported on small-pore zeolites and hydrotalcite" ***Catalysis Science and Technology* 2015**, 5, 380-388.

47) X. Feng, M.A. Carreon *, Kinetics of transformation on ZIF-67 crystals, ***Journal of Crystal Growth* 2015,** 418, 158-162.

46) A. Nambo, Carmen M. Miralda, Jacek B. Jasinski, M.A. Carreon *, "Methanolysis of Olive Oil for biodiesel synthesis over ZnO nanorods", ***Reaction Kinetics, Mechanisms and Catalysis* 2015**, 114, 583-595.

45) L. Yang, G. Ruess, M.A. Carreon *, "Cu, Al and Ga based metal organic framework catalysts for the decarboxylation of oleic acid" ***Catalysis Science and Technology* 2015,** 5, 2777-2782.

44) M. Ahmadi, E. E. Macias, J. B. Jasinski, P. Ratnasamy, M. A. Carreon*, "Decarboxylation and further transformation of oleic acid over bifunctional Pt/SAPO-11 catalysts and Pt/chloride $Al_2O_3$ catalysts" ***Journal of Molecular Catalysis A: Chemical,* 2014**, 386, 14.

43) Z. Xie, T.Li, N.L. Rosi, M.A. Carreon* "Alumina-supported cobalt–adeninate MOF membranes for $CO_2/CH_4$ separation" ***Journal of Materials Chemistry A* 2014**, 2, 1239-1241**.**

42) M. Zhu, M.A. Carreon*, "Porous crystals as active catalysts for the synthesis of cyclic carbonates" ***Journal of Applied Polymer Science* 2014**, 131, 39738.

41) S.R. Venna, M. Zhu, S. Li, M.A. Carreon * "Knudsen diffusion through ZIF-8 membranes synthesized by secondary seeded growth" ***Journal of Porous Materials* 2014,** 21, 235.

40) M. Zhu, D. Srinivas, S. Bhogeswararao, P. Ratnasamy, M.A. Carreon*, "Catalytic activity of ZIF-8 in the synthesis of styrene carbonate from $CO_2$ and styrene oxide", ***Catalysis Communications* 2013,** 32, 36-40.

39) Z. Xie, M. Zhu, A. Nambo, J.B. Jasinski, M.A. Carreon*, "Microwave-assisted synthesized SAPO-56 as catalyst in the conversion of $CO_2$ to cyclic carbonates" ***Dalton Transactions* 2013** 42, 6732-6735.

38) E.E. Macias, P. Ratnasamy, M.A. Carreon* "Catalytic activity of metal organic framework $Cu_3(BTC)_2$ in the cycloaddition of $CO_2$ to epichlorohydrin reaction" ***Catalysis Today* 2012**, 198, 215-218.

37) M.A. Carreon * "Metal Organic Frameworks as Catalysts in the Conversion of $CO_2$ to Cyclic Carbonates" ***Ind. Journal of Chemistry A* 2012**, 51A, 1306-1314

36) J.A. Bohrman, M.A.Carreon* "Synthesis and $CO_2/CH_4$ separation performance of Bio-MOF-1 Membranes" ***Chemical Communications* 2012**, 48, 5130-5132.

35) M. Zhu, J.B. Jasinski, M.A. Carreon * "Growth of Zeolitic Imidazolate Framework-8 Crystals from the Solid-liquid Interface" ***Journal of Materials Chemistry* 2012**, 22, 7684-7686.

34) M.L. Carreon, S. Li, M.A. Carreon *, "AlPO-18 Membranes for $CO_2/CH_4$ Separation" ***Chemical Communications* 2012,** 48, 2310.

33) C. Miralda, E.E. Macias, M. Zhu, P. Ratnasamy, M.A. Carreon*, "Zeolitic imidazole Framework-8 catalysts in the conversion of $CO_2$ to chloropropene carbonate" ***ACS Catalysis* 2012**, 2, 180-183.

32) M. Zhu, S.R. Venna, J.B. Jasinski, M.A. Carreon*, "Room temperature synthesis of ZIF-8: The coexistence of ZnO nanoneedles, ***Chemistry of Materials* 2011**, 23, 3590-3592.

31) C.A. Deshmane, J. B. Jasinski, P. Ratnasamy, M. A. Carreon*, " Epoxidation of Cyclooctene Over Mesoporous Ga, Ga-Nb, and Ga-Mo Mixed Oxide Catalysts" ***Catalysis Communications* 2011,** 15, 46-51.

30) S.R. Venna, M.A.Carreon*, "Amino-functionalized SAPO-34 membranes for $CO_2/CH_4$ and $CO_2/N_2$ separation" ***Langmuir* 2011,** 27, 2888-2894.
29) E. E. Macias, C.A. Deshmane, J. B. Jasinski, M. A. Carreon*, P. Ratnasamy, Catalytic Transformations of Methyl Oleate and Biodiesel Over Mesoporous Gallium-Niobium Oxides, ***Catalysis Communications* 2011,** *12* 644-650.
28) M.L. Carreon, H. G.Carreon, J. Espino-Valencia, M. A. Carreon*, "Photocatalytic degradation of organic dyes by mesoporous nanocrystalline anatase", ***Materials Chemistry and Physics* 2011**, *125*, 474-478.
27) S.R. Venna, Jacek B. Jasinski, M.A.Carreon*, "Structural Evolution of Zeolitic Imidazolate Framework-8" ***Journal of the American Chemical Society* 2010,** 132, 18030–18033.
26) C.A. Deshmane, J.B. Jasinski, P. Ratnasamy, M.A. Carreon* Synthesis and catalytic properties of mesoporous, bifunctional, gallium-niobium mixed oxides, ***Chemical Communications* 2010,** *46*, 6347-6349.
25) S. Li, M.A. Carreon, Y. Zhang, H. H. Funke, R.D. Noble, J.L. Falconer, "Scale-up of SAPO-34 Membranes for $CO_2/CH_4$ Separation", ***Journal of Membrane Science* 2010,** *352*, 7-13.
24) S.R. Venna, M.A.Carreon*, "Highly Permeable Zeolite Imidazolate Framework-8 Membranes for $CO_2/CH_4$ Separation", ***Journal of the American Chemical Society* 2010,** *132*, 76-78.
23) C.A. Deshmane J.B.Jasinski, M.A.Carreon*, "Microwave-assisted synthesis of nanocrystalline gallium oxide", ***Microporous and Mesoporous Materials* 2010**, *130*, 97-102.
22) A. Katti, S.R. Venna, M.A. Carreon*, "Self assembly hydrothermal assisted synthesis of mesoporous anatase in the presence of ethylene glycol", ***Catalysis Communications* 2009**, *10*, 2036-2040.
21) C.A. Deshmane J.B. Jasinski, M.A.Carreon*, "Thermally Stable Nanocrystalline Mesoporous Gallium Oxide Phases", ***European Journal of Inorganic Chemistry* 2009**, *22*, 3275-3281.
20) S.R. Venna, M.A.Carreon*, "Microwave assisted phase transformation of silicoaluminophosphate zeolite crystals", ***Journal of Materials Chemistry* 2009,** *19*, 3138-3140.
19) M.A. Carreon, V.V. Guliants, M. Olga Guerrero-Perez, Miguel A. Bañares, "Mesostructured mixed Mo-V-Nb oxides for propane ammoxidation", ***Catalysis Communications* 2009,** *10*, 416-420.
18) S.R. Venna, M.A. Carreon*, "Synthesis of SAPO-34 crystals in the presence of crystal growth inhibitors**", *Journal of Physical Chemistry B* 2008,** *112*, 16261-16265.
17) M.A. Carreon, S.Li, J.L. Falconer, R.D. Noble, "Alumina-Supported SAPO-34 Membranes for $CO_2/CH_4$ Separation" ***Journal of the American Chemical Society* 2008**, *130*, 5412-5413.
16) M.A. Carreon, S.Li, J.L. Falconer, R.D. Noble "SAPO-34 Seeds and Membranes Prepared Using Multiple Structure Directing Agents" ***Advanced Materials* 2008**, *20*, 729-732.
15) M.A. Carreon, S.-Y. Choi, M. Mamak, N. Chopra, G.A. Ozin, "Pore Architecture Affects Photocatalytic Activitiy of Periodic Mesoporous Nanocrystalline Anatase Thin Films" ***Journal of Materials Chemistry* 2007**, *17*, 82-89.
14) M.A. Carreon, V.V. Guliants, L. Yuan, A.R. Hughett, A. Dozier, G.A. Seisenbaeva, V.G. Kessler, "Mesoporous Nanocrystalline Mixed Metal Oxides from Heterometallic Alkoxide Precursors: Spinel Cobalt-Nickel Oxide Spinels for Propane Oxidation" ***European Journal of Inorganic Chemistry* 2006**, *24*, 4983-4988.
13) E.E. Macias, J.C. Corral-Huacuz, M.E. Contreras, M.A. Carreon* "Thermally stable mesoporous barium-iron mixed oxide phases" ***Materials Letters* 2006**, *60*, 2119-2124.
12) E.E. Macias, V.V. Guliants, M.A. Carreon* "Mesostructured and mesoporous pure and substituted barium hexaferrites" ***Studies in Surface Science and Catalysis* 2005,** *156*, 287-294.
11) M.A. Carreon and V.V. Guliants, "Synthesis of catalytic materials on multiple length scales: From mesoporous to macroporous bulk mixed metal oxides for selective oxidation of hydrocarbons", ***Catalysis Today* 2005,** *99*, (1-2) 137-142.
10) M.A. Carreon and V.V. Guliants, "Ordered meso and macroporous binary and mixed metal oxides", ***European Journal of Inorganic Chemistry* 2005** , *1*, 27-43.
9) M.A. Carreon , V.V. Guliants, M. O. Guerrero, M.A. Bañares "Phase transformations in mesostructured VPO/Surfactant composites*", **Microporous and Mesoporous Materials* 2004**, *71* (1-3) 57-63.

8) V.V. Guliants, M.A. Carreon, J.Y. Lin "Ordered mesoporous and macroporous inorganic films and membranes", ***Journal of Membrane Science*** **2004**, *235* (1-2) 53-72.
7) M.A. Carreon ,V.V. Guliants, F. Pierelli, F. Cavani "Ordered mesostructured mixed metal oxides:microporous VPO phases for n-butane oxidation to maleic anhydride", ***Catalysis Letters*** **2004**, *92* (1-2) 11-16.
6) M.A. Carreon and V.V. Guliants, "Phase transformations in mesostructured vanadium-phosphorus oxides", ***Catalysis Today*** **2003**, *78* (1-4), 303-310.
5) M.A. Carreon and V.V. Guliants, "Synthesis and characterization of mesostructured vanadium-phosphorus-oxide phases", ***Studies in Surface Science and Catalysis*** **2002**, *141*, 301-308.
4) M.A. Carreon and V.V. Guliants, "Novel macroporous vanadium-phosphorus oxides with three-dimensional arrays of spherical voids", ***Studies in Surface Science and Catalysis*** **2002**, *141*, 309-316.
3) M.A. Carreon and V.V. Guliants, "Mesostructured vanadium-phosphorus oxide phases", ***Microporous and Mesoporous Materials*** **2002**, *55*, 3, 297-304.
2) M.A. Carreon and V.V. Guliants, "Macroporous vanadium phosphorus oxide phases displaying three-dimensional arrays of spherical voids" ***Chemistry of Materials*** **2002** , *14*, 6, 2670-2675.
1) M.A. Carreon and V.V. Guliants, "Hierarchical design of mixed metal oxides: novel macroporous VPO phases", ***Chemical Communications*** **2001**, *16*, 1438-1439.

* denotes publication as corresponding author

## Book Chapters (7)

7. L. Yang, M.A. Carreon*, Green deoxygenation of fatty acids to transport fuels over metal–organic frameworks as catalysts and catalytic supports" 9, 285-318 on Metal Organic Frameworks for Environmental Application. Elsevier **2019.**
6. S. Li, Z. Zong, M. Yu, M.A. Carreon* "Membrane Processes for $N_2/CH_4$ separation" 4, 145-194 on Membranes for Gas Separations, World Scientific Series in Membrane Science and Technology; Biological and Biomimetic Applications, Energy and the Environment, **2017**.
5. M.A. Carreon* , T.Q. Gardner, "Microporous crystalline .membranes and their application for $CO_2$ separation" on Pore Scale Phenomena: Frontiers in Energy and Environment, World Scientific, 10, 401-434, **2015**.
4. M.A. Carreon, V.V. Guliants "Selective Oxidation of n-butane over vanadium-phosphorus oxide" on *Nanostructured Catalysts: Selective Oxidations* 6, 141-168, The Royal Society of Chemistry **2011.**
3. M.A. Carreon, V.V. Guliants "Catalysts Design Through Dual Templating" Book Chapter, 12, 295-314, *Design of Heterogeneous Catalysis. New Approaches based on Synthesis, Characterization and Modeling*, Wiley-VCH **2009.**
2. M.A. Carreon, V.V. Guliants "Mesostructuring Metal Oxides through Evaporation Induced Self-Assembly: Fundamentals and Applications" Book Chapter, 16, 407-432, *Nanoporous Solids, Recent Advances and Prospects*, Elsevier **2008.**
1. V.V. Guliants, M.A. Carreon, "Vanadium-Phosphorus-Oxides: from fundamentals of *n*-Butane to Synthesis of New Phases" Book Chapter, Catalysis, Vol.18, The Royal Society of Chemistry **2005**, 1-45.
* denotes publication as corresponding author

## Books

1. M.A. Carreon*, S.R. Venna "Metal Organic Framework Membranes for Molecular Gas Separations". Volume 6. ISBN: ISBN 978-1-78634-672-8. World Scientific. **2020**.

## Edited Books

1. M.A. Carreon* "Membranes for Gas Separations". World Scientific Series in Membrane Science and Technology; Biological and Biomimetic Applications, Energy and the Environment, Volume 1, 376 pages. ISBN: 978-981-3207-70-7, **2017**.

## Issued Patents (5)

5. S. Li, S. Zhou, H.S. Meyer, M. Yu, M.A. Carreon, "Method for loading and storing gas in nanovalved-adsorbents", US Patent No. 9,249,934 B2, **2016**.
4. S. Li, S. Zhou, M. Yu, M.A. Carreon, "Nano-channel enhanced composite membranes", US Patent No. 9,005,345 B2, **2015**.
3. P. Ratnasamy; M.A. Carreon; C. Deshmane, "Catalytic isomerisation of linear olefinic hydrocarbons", US Patent No. 8,785,709, **2014**.
2. M.A. Carreon; Z. Diaz; J.L. Falconer; H.H. Funke; S. Li; B.D. Murray; R.D. Noble; W. P. Jason; "Method of Making a High-Performance Supported Gas Separation Molecular Sieve Membrane Using a Shortened Crystallization Time", US Patent No. 8,685,143, **2014**.
1. J.L Falconer; M.A Carreon ; S. Li; R.D. Noble; " Synthesis of zeolites and zeolite membranes using multiple structure directing agents", US Patent No. 8,302,782, **2012**.

## Funding

Current and Past sponsors: NSF, ARPA-E DOE, NEUP-DOE, BES-DOE, ACS-PRF, KSEF, DEDI, University, and International sources (CONACYT, Mexico).

## Conferences and Presentations

> 80 Technical Conferences in Regional, National, and International Meetings, including mainly presentations at: American Institute of Chemical Engineers (AIChE); Materials Research Society (MRS); American Chemical Society (ACS); North American Membrane Society (NAMS); North American Catalysis Society (NACS); ICOM (International Conference on Membranes); and Gordon Conferences.

## Selected invited presentations

- Speaker for the upcoming "2022 Gordon Research Conference: Membranes, Materials and Processes. *Convergence in Membrane Research Across Disciplines and Scales* (August 2022; Colby Sawyer College, New Hampshire). Session: Rational Design of Membrane Materials
- "Separation of Kr/Xe mixtures over Molecular Sieve Membranes". Plenary session. AIChE, Pittsburgh, PA. October 2018.
- "Zeolite membranes for carbon dioxide capture: Scaling up challenges". Plenary talk. UMSNH, Mexico, October 2018.
- "Microporous crystalline membranes for Kr/Xe separation", Princeton University. Chemical & Biological Engineering Department. November 2017.
- "Porous membranes for Kr/Xe separation", invited presentation at ACS, Philadelphia, PA, August 2016.
- "Zeolite vs MOF membranes: which is best"? invited presentation at AIChE, San Francisco, CA November 2013.
- "Novel membranes for efficient $CO_2$ separation" invited presentation at 22$^{nd}$ National NSF EPSCoR Conference. Coeur d'Alene, Idaho, October 27, 2011 (only 3 NSF CAREER awardees were invited to present).
- "SAPO-34 and ZIF-8 membranes for carbon dioxide separation" invited presentation in the Chemical & Biomolecular Engineering Department at Ohio University (Graduate Seminar Series). Athens, OH. May 11, 2010.

- "Zeolite and metal organic framework membranes for carbon dioxide purification" invited presentation in the Chemistry Department at Lehigh University (Graduate Seminar Series). Bethlehem, PA. April 14, 2010.
- "Molecular Design of Ordered Porous Materials for Functional Applications in Catalysis and Gas Separations" invited presentation in the Chemical Engineering Department at UMSNH-Mexico (Graduate Seminar Series), Morelia, Mexico. July 16, 2009.
- "Improved SAPO-34 Membranes for carbon dioxide purification" invited presentation in the Chemical & Materials Engineering Department at University of Cincinnati (Graduate Seminar Series). Cincinnati, OH. March 5, 2009.
- "Molecular engineered zeolite membranes for light gas separations". Chemical Engineering Department. ITESM, Monterrey, NL, Mexico, October 2006.
- "Periodic ordered meso and macroporous oxides for nanotechnological applications". Chemical Engineering Department. University of Ottawa. Ottawa, Canada, July 2006.
- "Photocatalytic degradation of methylene blue on nanocrystalline mesoporous anatase thin films". Materials Research Institute. U.N.A.M. Morelia, Mexico, December 2005.
- "Functional applications of ordered periodic nanoporous inorganic oxides on different length scales". Mexican, Petroleum Institute (IMP). Mexico City, May 2004.
- "Hierarchical design of porous mixed metal oxides for selective oxidation of lower alkanes". Chemical Engineering Department. Princeton University. Princeton, NJ. March 2003.

## Teaching

- Chemical Engineering Separations (undergraduate level)
- Advanced Reactor Design and Kinetics (core course graduate level)
- Materials Science & Engineering (undergraduate level)
- Advanced Porous Functional Materials (dual level)
- Principles of Fluid Dynamics (undergraduate level)
- Renewable Energy Systems (graduate level)
- Membrane Separation Technology (graduate level)
- Unit Operations Laboratory (undergraduate level)
- Mass Transfer (undergraduate level)
- Chemical Engineering Separations (undergraduate level)
- Introduction to Research (graduate level)

## Synergistic Activities

- Chairman of the *Diversity, Inclusion and Access* committee (2020). Department of Chemical & Biological Engineering Department. Colorado School of Mines.
- Faculty Advisor for Society of Hispanic Professional Engineers (SHPE). In 2010, established and initiated the SHPE Chapter at University of Louisville.
- Manuscript Referee for *Science, PNAS, Journal of the American Chemical Society, Nature Communications, Chemistry of Materials, Journal of Materials Chemistry, Journal of Membrane Science, Journal of Physical Chemistry B, Catalysis Communications, ACS-Catalysis, ChemCatChem, Industrial & Engineering Chemistry Research, Langmuir, European Journal of Inorganic Chemistry, Materials Chemistry and Physics, Journal of Coordination Chemistry, Dalton Transactions, Electrophoresis, Chemical Communications, Angewandte Chemie, Microporous and Mesoporous Materials,* Review ~5-6 papers/month
- Session Chair 2018 ACS Fall National Meeting, Boston, MA, August 2018, "ENFL: Biomass to Energy, Chemicals & Functional Materials session".

- Session Chair 2014 ACS National meeting. Symposium entitled "Carbon Dioxide management: Recent advances in carbon dioxide capture, conversion and utilization" San Francisco CA.
- Session Chair, 2010 North American Membrane Society Meeting, Washington D.C. July 2010, "Prefilters and Fiber-based Membranes session"
- Editor of the book "Membranes for Gas Separations". World Scientific Series in Membrane Science and Technology; Biological and Biomimetic Applications, Energy and the Environment, Volume 1, 376 pages. ISBN: 978-981-3207-70-7, 2017.
- Editorial Board for the *Journal of Materials*.
- Editorial Board for the *Journal of Chemical Technology & Biotechnology*
- Editorial Board for *Membranes*.
- Proposal reviewer for NSF (CBET, CAREER, GRFP), NEUP-DOE, BES-DOE, ACS-PRF.
- Development of the graduate course "Functional Nanoporous Materials". University of Louisville, Chemical Engineering Department. Spring 2010.
- External PhD advisor for the Project: "Nanocrystalline titania-alumina for the photo-oxidative degradation of pollutants". Materials Research Institute, University of Michoacan, Mexico. 2006-2011.

## Graduate Thesis Advisor

At U.M.S.N.H, Mexico:

- 3 M.S. students: Eugenia E. Macias (Graduated 2004), Azucena Lara (Graduated 2005), Lorena Garcia (Graduated 2005).

At UofL:

- 3 graduated PhD students: Minqi Zhu (2013), Chinmay Deshmane (2011); Surendar Venna (2010).
- 4 graduated MS students: Zhenzhen Xie (2013), Carmen Miralda (2012), Joseph Bohrman (2012); Amruta Katty (2009)

At Colorado School of Mines :

- 2 graduated MS students: Xuhui Feng (2016); Kirby Tate (2016)
- 4 graduated PhD students: Zhaowang Zong (2017); Liqiu Yang(2017); Ting Wu (2018); Jolie Lucero (2019)

Currently: 4 PhD students: James Crawford ; Shurraya Denning; Quishi Wei, Keerthana Khrisnan.

## Collaborators

- Jennifer Wilcox (University of Pennsylvania)
- Shiguang Li (Gas Technology Institute)
- Miao Yu (Rensselaer Polytechnic Institute)
- Nathaniel Rosi (University of Pittsburgh)
- Stephanie Wettstein (Montana State University)
- Praveen Thallapally (PNNL)
- Maria Carreon (South Dakota School of Mines & Technology)
- Richard Noble (University of Colorado)
- Doug Gin (University of Colorado)
- Brian Trewyn (Colorado School of Mines)
- Alan Sellinger (Colorado School of Mines)
- Svitlana Pylypenko (Colorado School of Mines)
- Diego Gomez-Gualdron (Colorado School of Mines)
- Carolyn Koh (Colorado School of Mines)
- Colin Wolden (Colorado School of Mines)
- Doug Way (Colorado School of Mines)