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Date of Birth: 12/23/1984



Research Interest

Material chemistry & engineering at the Å length-scale for high-performance inorganic & hybrid membranes for energy-efficient molecular separation

Education

Ph.D., Chemical Engineering, University of Minnesota, Minneapolis, MN, USA 2008-2013
Advisors: Prof. Michael Tsapatsis, Prof. Lorraine F. Francis
Thesis: Dispersible exfoliated zeolite nanosheets and their application in high performance zeolite membranes

B. Tech., Chemical Engineering, IIT Bombay, Mumbai, India 2001-2005
(Department Rank: 1, Institute Silver Medal)

Professional Experience

Associate Professor, GAZNAT Chair for Advanced Separations Jan 2023- present
École Polytechnique Fédérale de Lausanne (EPFL), Switzerland

Assistant Professor, GAZNAT Chair for Advanced Separations July 2016- Dec 2016
École Polytechnique Fédérale de Lausanne (EPFL), Switzerland

Postdoctoral Research Assistant July 2014 – June 2016
Department of Chemical Engineering, Massachusetts Institute of Technology (MIT), USA
Advisor: Prof. Michael S. Strano

Postdoctoral Research Assistant Nov 2013 - June 2014
Department of Chemical Engineering & Material Science, University of Minnesota, USA
Advisor: Prof. Michael Tsapatsis, Prof. Lorraine Francis

Engineer Nov 2005 - May 2008
Global Hair Care R&D, Procter & Gamble, Kobe, Japan

Publications

Google Scholar: <https://scholar.google.com/citations?user=uBT9VEEAAAAJ&hl=en&oi=ao>

Publications at EPFL

1. M. T. Vahdat, S. Li, S. Huang, C. A. Pignedoli, Marzari, K. V. Agrawal*, "Unraveling the Oxidation of Graphitic Lattice : Structure Determination of Oxygen Clusters". Submitted.
2. K.-J. Hsu, S. Li, M. Micari, H.-Y. Chi, L. Zhong, L. F. Villalobos, S. Huang, X. Duan, A. Züttel, K. V. Agrawal*, "Pyridinic Nitrogen Substituted Two-Dimensional Pores for Rapid and Selective CO₂ Transport". Submitted.
3. Q. Liu, Y. Miao, L. F. Villalobos, S. Li, D. J. Babu, H.-Y. Chi, M. T. Vahdat, J. Hao, Y. Han, M. Tsapatsis, K. V. Agrawal*, "Nanometer-Thick Crystalline and Amorphous Zeolite Imidazolate Frameworks Films for Membrane and Patterning Applications", Submitted.

4. X. Duan, M. Dakhchoune, J. Hao, K. V. Agrawal, “Scalable Room-Temperature Synthesis of a Hydrogen-Sieving Zeolitic Membrane on a Polymeric Support”. **ACS Sustainable Chemistry & Engineering**, 11, 8140–8147, 2023.
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5. X. Duan, M. Dakhchoune, J. Hao, K. V. Agrawal, Scalable Room-Temperature Synthesis of Hydrogen-Sieving Zeolitic Membrane on Polymeric Support. **Journal of Membrane Science Letters**, 3, 100045, 2023.
 - Invited manuscript.
6. M. Micari, X. Duan, K. V. Agrawal*, “Atmospheric Water Harvesting in Semi-Arid Regions by Membranes : A Techno-Economic Assessment. **Journal of Membrane Science**, 672, 121437, 2023.
7. M. Dakhchoune, X. Duan, L. F. Villalobos, C. E. Avalos, K. V. Agrawal*, “Hydrogen-Sieving Zeolitic Films by Filter Deposition on Porous Polymeric Support”, **Journal of Membrane Science**, 672, 121454, 2023.
8. R. Castro-Muñoz*, K. V. Agrawal*, Z. Lai*, J. Coronas* “Towards Large-Scale Application of Nanoporous Materials in Membranes for Separation of Energy-Relevant Gas Mixtures”, **Separation and Purification Technology**, 308, 122919, 2023.
9. I. Nulens, R. Peters, R. Verbeke, D. M. Davenport, C. Van Goethem, B. De Ketelaere, P. Goos, K. V. Agrawal, I. F. J. Vankelecom*, “MPD and TMC Supply as Parameters to Describe Synthesis-Morphology-Performance Relationships of Polyamide Thin Film Composite Membranes”, **Journal of Membrane Science**, 667, 121155, 2023.
10. S. Huang, L. F. Villalobos, S. Li, M. T. Vahdat, H.-Y. Chi, K. Hsu, L. Bondaz, V. Boureau, N. Marzari, K. V. Agrawal*, “In Situ Nucleation-Decoupled and Site-Specific Incorporation of Å-Scale Pores in Graphene via Epoxidation”, **Advanced Materials**, 2206627, 2022.
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11. M. T. Vahdat, K. V. Agrawal, Giovanni Pizzi*, “Machine-learning accelerated identification of exfoliable two-dimensional materials”, **Machine Learning: Science and Technology**, 3, 045014, 2022.
12. L. F. Villalobos, D. J. Babu, K. Hsu, C. Van Goethem, K. V. Agrawal*, “Gas Separation Membranes with Atom-Thick Nanopores: The Potential of Nanoporous Single-Layer Graphene”. **Accounts of Material Research**, 3, 1073-1087, 2022.
13. H.-Y. Chi, C. Chen, K. Zhao, L. F. Villalobos, P. A. Schouwink, L. Piveteau, K. Marshall, Q. Liu, Y. Han*, K. V. Agrawal*, “Unblocking Ion-Occluded Pore Channels in Poly (Triazine Imide) Framework for proton conduction”, **Angewandte Chemie International Edition**, 61, e202207457, 2022.
14. W. Lee, A. Ronghe, L. F. Villalobos, S. Huang, M. Dakhchoune, M. Mensi, K.-J. Hsu, K. G. Ayappa*, K. V. Agrawal*, “Enhanced Water Evaporation from Å-Scale Graphene Nanopores”, **ACS Nano**, 16, 15382–15396, 2022.
15. K. V. Agrawal, R. Bautz, “Capture du carbone par membranes en graphène à nanopores”, Capture Du Carbone. **Aqua & Gas**. 2022, pp 46–53.

16. R. Hu, Y. Sun, L. Li, T. Wang, H. Kanda, C. Liu, Y. Yang, S. Huang, A. M. Asiri, L. Chu, X. Li, K. V. Agrawal, M. K. Nazeeruddin*, “Crack-Free Monolayer Graphene Interlayer for Improving Perovskite Crystallinity and Energy Level Alignment in Efficient Inverted Perovskite Solar Cells”, **Solar RRL**, 2200484, 1–9, 2022.
17. K. Adriaensen, J. Vercammen, C. Van Goethem, K. V. Agrawal, D. E. De Vos*, “In depth analysis of heterogeneous catalysts for the chemoenzymatic dynamic kinetic resolution of beta-amino esters”, **Catalysis Science & Technology**, 12, 2894-2902, 2022.
18. M. Rezaei, L. F. Villalobos, K.-J. Hsu, K. V. Agrawal*, “Demonstrating and Unraveling a Controlled Nanometer-Scale Expansion of the Vacancy Defects in Graphene by CO₂”, **Angewandte Chemie International Edition**, 61, e202200321, 2022.
 - Featured on the cover page.
19. S. Li, M. T. Vahdat, S. Huang, K.-J. Hsu, M. Rezaei, N. Marzari, K. V. Agrawal*, “Structural Evolution during the Oxidation of Graphitic Materials for the Generation of Vacancy Defects” **JACS Au**, 2, 723-730, 2022.
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20. M. Dakhchoune, X. Duan, L. F. Villalobos, K.-J. Hsu, J. Zhao, M. Micari, K. V. Agrawal*, “Rapid gas transport from nanometer-sized channels in block-copolymer templated nanoporous carbon film” **Industrial & Engineering Chemistry Research**, 44, 16100, 2022.
21. M. Micari, K. V. Agrawal*, “Oxygen Enrichment of Air : Performance Guidelines for Membranes Based on Techno-Economic Assessment”, **Journal of Membrane Science**. 641, 119883, 2022.
22. M. T. Vahdat, D. Campi, N. Colonna, N. Marzari*, K. V. Agrawal*, “Gas Transport across Carbon Nitride Nanopores: A Comparison of van-Der-Waals Functionals against the Random-Phase Approximation”, **The Journal of Physical Chemistry C**. 125, 18896-18904, 2021.
23. S. Huang, S. Li, K.-J. Hsu, L. F. Villalobos, K. V. Agrawal*, “Systematic design of millisecond gasification reactor for the incorporation of gas-sieving nanopores in single-layer graphene”, **Journal of Membrane Science**. 637, 119628, 2021.
 - Invited article (ICOM issue)
24. K.-J. Hsu, L. F. Villalobos, S. Huang, H. Chi, W. Lee, G. He, M. Mensi, K. V. Agrawal*, “Multi-pulsed millisecond ozone gasification for predictable tuning of nucleation and nucleation-decoupled nanopore expansion in graphene for carbon capture”, **ACS Nano**, 15, 13230-13239, 2021.
25. L. F. Villalobos, C. Van Goethem, K.-J. Hsu, M. Moradi, M. Dakhchoune, S. Huang, Y. Shen, E. Oveisi, V. Boureau, K. V. Agrawal*, “Bottom-up synthesis of graphene films hosting atom-thick molecular-sieving apertures”, **Proceedings of the National Academy of Sciences**. 118, e2022201118, 2021.
 - Invited article for Membranes Special Issue
26. J. Hao, D. J. Babu, Q. Liu, A. Schouwink, M. Asgari, L. Wendy, Q, K. V. Agrawal*, “Mechanistic study on thermally-induced lattice stiffening of ZIF-8”. **Chemistry of Materials**, 33, 4035–4044, 2021.
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27. M. Micari, M. Dakhchoune, K. V. Agrawal*, “Techno-economic assessment of postcombustion carbon capture using high-performance nanoporous single-layer graphene membranes”, **Journal of Membrane Science**, 624, 119103, 2021.
28. S. Huang, S. Li, L. F. Villalobos, M. Micari, D. J. Babu, M. T. Vahdat, M. Mensi, E. Oveisi, K. V. Agrawal*, “Millisecond lattice gasification for high-density CO₂- and O₂-sieving nanopores in single-layer graphene”, **Science Advances**, 7, eabf0116, 2021
29. L. F. Villalobos, S. Huang, M. Dakhchoune, G. He, W.-C. Lee, K. V. Agrawal*, “Polybenzimidazole copolymer derived lacey carbon film for graphene transfer and contamination removal strategies for imaging graphene nanopores”, **Carbon**, 173, 983-988, 2021.
30. W. Lee, L. Bondaz, S. Huang, G. He, M. Dakhchoune, K. V. Agrawal*, "Centimeter-Scale Gas-Sieving Nanoporous Single-Layer Graphene Membrane", **Journal of Membrane Science**, 618, 118745, 2021.
31. M. Dakhchoune, L. F. Villalobos, R. Semino, L. Liu, M. Rezaei, P. Schouwink, C. E. Avalos, P. Baade, V. Wood, Y. Han, M. Ceriotti, K. V. Agrawal*, “Gas sieving zeolitic membranes by the condensation of precursor nanosheets”, **Nature Materials**, 20, 362-369, 2021.
32. Q. Liu, D. J. Babu, M. T. Vahdat, D. Campi, K. V. Agrawal*, “Metal Soap Membranes for Gas Separation”, **Advanced Functional Materials**, 31, 2005629, 2021.
33. M. T. Vahdat, D. Campi, N. Colonna, L. F. Villalobos, N. Marzari*, K. V. Agrawal*, “Efficient Kr/Xe separation from triangular g-C₃N₄ nanopores”, **Journal of Material Chemistry A**, 8, 17747-17755, 2020.
34. M. Rezaei, S. Li, S. Huang, K. V. Agrawal*, “Hydrogen-sieving single-layer graphene membranes obtained by crystallographic and morphological optimization of catalytic copper foil”, **Journal of Membrane Science**, 612, 118406, 2020.
 - Editor’s Choice article (June 2020).
35. G. He, S. Huang, L. F. Villalobos, M. T. Vahdat, M. D. Guiver, J. Zhao, W.-C. Lee, M. Mensi, K. V. Agrawal*, “Synergistic CO₂-sieving from polymer with intrinsic microporosity masking nanoporous single-layer graphene”, **Advanced Functional Materials**, 2003979, 1-10, 2020.
36. R. Castro-Muñoz*, K. V. Agrawal*, J. Coronas*, “Ultrathin permselective membranes: The latent way for an efficient gas separation”, **RSC Advances**, 10, 12653- 12670, 2020.
 - Review article.
37. J. Hao, D. J. Babu, Q. Liu, C. Lu, Y. Liu, and K. V. Agrawal*, "Synthesis of high-performance polycrystalline metal–organic framework membranes at room temperature in a few minutes”, **Journal of Material Chemistry A**, 8, 7633-7640, 2020.
 - Featured on the cover page (back).
38. L. F. Villalobos, M. T. Vahdat, M. Dakhchoune, Z. Nadizadeh; M. Mensi, E. Oveisi, D. Campi, N. Marzari, K.V. Agrawal*, “Large-scale synthesis of crystalline g-C₃N₄ nanosheets and high-temperature H₂ sieving from assembled films”, **Science Advances**, 6, eaay9851, 2020.
39. G. He, S. Huang, L. F. Villalobos, J. Zhao, M. Mensi, E. Oveisi, M Rezaei, K. V. Agrawal*, “High-permeance polymer-functionalized single-layer graphene membranes that surpass the postcombustion carbon capture target”, **Energy & Environmental Sciences**, 12, 3305-3312, 2019.
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40. M. H. Khan, M. Dakhchoune, M. Rezaei, S. Huang, J. Zhao, K. V. Agrawal*, "Hydrogen sieving from intrinsic defects of benzene-derived single-layer graphene", **Carbon**, 153, 458-466, 2019.
41. A. Bananezhad, M. Jovic, L. F. Villalobos, K. V. Agrawal, M. R. Ganjali, H. H. Girault*, "Large-scale fabrication of flexible solid-state reference electrodes", **Journal of Electroanalytical Chemistry** 847, 113241, 2019.
42. D. J. Babu, G. He, M. T. Vahdat, P. A. Schouwink, M. Mensi, K. V. Agrawal*, "Restricting lattice flexibility in polycrystalline metal-organic framework membrane for carbon capture", **Advanced Materials**, 31, 1900855, 2019.
43. S. Huang, L. F. Villalobos, D. J. Babu, G. He, M. Li, A. Züttel, K. V. Agrawal*, "Ultrathin and size-tunable carbon molecular sieve membrane for gas separation", **ACS Applied Materials & Interfaces**, 11, 16729-16736, 2019.
44. S. Dutta, M. Rezaei, K. V. Agrawal*, "Crystallization of gas-selective nanoporous graphene by chemical vapor deposition: a modeling study by kinetic Monte Carlo simulation". **Scientific Reports**, 9, 5202, 2019.
45. J. Zhao, G. He, S. Huang, L. F. Villalobos, M. Dakhchoune, H. Bassas, E. Oveisi, K. V. Agrawal*, "Etching gas-sieving nanopores in single-layer graphene with an angstrom precision for high-performance gas mixture separation". **Science Advances**, 5, eaav1851, 2019.
46. D. Babu, G. He, L. F. Villalobos, K. V. Agrawal* "Crystal engineering of metal organic thin films for gas separations", **ACS Sustainable Chemistry & Engineering**, 7,49, 2019.
 - Invited review article.
47. G. He., D. J. Babu, K. V. Agrawal*, "Electrophoretic crystallization of ultrathin high-performance metal-organic framework membranes". **Journal of Visualized Experiments**, 138, e58301, doi:10.3791/58301 (2018).
48. S. Huang, M. Dakhchoune, W. Luo, E. Oveisi, G. He, M. Rezaei, J. Zhao, A. Züttel, M. S. Strano, K. V. Agrawal*, "Single-layer graphene membranes by crack-free transfer for gas mixture separation". **Nature Communications**, 9, 2632, 2018.
49. K. V. Agrawal, "Towards the ultimate membranes: two-dimensional nanoporous materials and films", **Chimia**, 72, 313-321, 2018.
 - Invited perspective article.
50. G. He., M. Dakhchoune, J. Zhao, S. Huang, K. V. Agrawal*, "Electrophoretic nuclei assembly for crystallization of high performance membranes on unmodified supports", **Advanced Functional Materials**, 28, 1707427, 2018.

Publications before EPFL

51. D. O. Bellisario, A. T. Liu, D. Kozawa, R. Han, J. K. Harris, R. B. Zabala, Q. H. Wang, K. V. Agrawal, Y. Son, M. S. Strano*, "Experimental Observation of Real Time Molecular Dynamics Using Electromigrated Tunnel Junctions", **The Journal of Physical Chemistry C**, 121, 22550–22558, 2017.
52. Z. Yuan, A. G. Rajan, L. W. Drahushuk, R. P. Mishra, K. V. Agrawal, M. S. Strano, D. Blankshtein*, "Mechanism and Prediction of Gas Permeation through Sub-Nanometer Graphene Pores: Comparison of Theory and Simulation", **ACS Nano**, 11 (8), 7974–7987, 2017.

53. K. V. Agrawal, Jesse Benck, Zhe Yuan, Yannick Eatmon, Ananth Govind Rajan, Suneet Kale, Ximo S. Chu, Duo O. Li, Chuncheng Gong, Daniel Blankschtein, Jamie Warner, Qing Hua Wang, Michael S. Strano*, "Fabrication, Pressure Testing and Nanopore Formation of Single Layer Graphene Membranes", **The Journal of Physical Chemistry C**, 121, 14312-14321, 2017.
54. M. H. Shete, M. Kumar, D. Kim, N. Rangnekar, B. Topuz, K.V. Agrawal, E. Karapetrova, B. Stottrup, S. Al-Thabaiti, S. Basahel, K. Narasimharao, J. D. Rimer, M. Tsapatsis*, "Nanoscale Control of Homoepitaxial Growth on a Two-Dimensional Zeolite", **Angewandte Chemie International Edition**, 56, 2, 535, 2017.
55. K. V. Agrawal, S. Shimizu, L. W. Drahushuk, D. Kilcoyne, M. S. Strano*, "Observation of Extreme Phase Transition Temperatures of Water Confined Inside Isolated Carbon Nanotube Nanopores", **Nature Nanotechnology**, 12, 267, 2017.
56. K. V. Agrawal, L. W. Drahushuk, D. Kilcoyne, M. S. Strano*, "Observation and Analysis of the Coulter Effect Through Carbon Nanotube and Graphene Nanopores", **Philosophical Transactions of the Royal Society A** (Invited Article), 374, 20150357, 2016.
- Invited review article.
57. S. Shimizu, K. V. Agrawal, M. O'Mahony, L. W. Drahushuk, N. Manohar, A. S. Myerson, M. S. Strano*, "Understanding and Analyzing Freezing-Point Transitions of Confined Fluids within Nanopores", **Langmuir**, 31, 10113, 2015.
58. K. V. Agrawal, B. Topuz, N. Sauer, T. C. T. Pham, N. Rangnekar, H. Zhang, K. Narasimharao, S. Basahel, L. F. Francis, C. W. Macosko, S. Al-Thabaiti, K. B. Yoon, M. Tsapatsis*, "Oriented MFI Membranes by Gel-less Secondary Growth of Sub-100 nm MFI-nanosheet Seed Layers", **Advanced Materials**, 21, 3243, 2015.
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59. N. Rangnekar, M. Shete, K. V. Agrawal, B. Topuz, P. Kumar, K. Narasimharao, I. Ismail, A. Alyoubi, S. Basahel, L. F. Francis, C. W. Macosko, K. A. Mkhoyan, B. Stottrup, S. Al-Thabaiti, M. Tsapatsis*, "2D Zeolite Coatings: Langmuir-Schaefer Deposition of 3 nm Thick MFI Zeolite Nanosheets", **Angewandte Chemie International Edition**, 54, 6571, 2015.
60. P. Kumar, K. V. Agrawal, M. Tsapatsis, A. Mkhoyan, "Quantification of Thickness and Wrinkling of Exfoliated Two-dimensional Zeolite Nanosheets", **Nature Communications**, 6, 7128, 2015.
61. P. Kumar, K. V. Agrawal, M. Tsapatsis*, A. Mkhoyan*, "Analytical Method for Thickness and Wrinkling Measurements of 2-D Zeolites", **Microscopy and Microanalysis**, 21, 2367-2368, 2015.
62. P. Kumar, K. V. Agrawal, M. Tsapatsis*, A. Mkhoyan*, "Crystallographic Structure Determination of MFI-Zeolite Nanosheets", **Microscopy and Microanalysis**, 20 (S3), 390-391, 2014.
63. K. V. Agrawal, B. Topuz, M. Navarro, Z. Jiang, K. Nguenkam, B. Elyassi, L. F. Francis, M. Tsapatsis*, "Solution-processable Exfoliated Zeolite Nanosheets Purified by Density Gradient Centrifugation", **AIChE Journal**, 59, 3458, 2013.
- Invited article in the special issue of AIChE J. Founders Tribute to Neal R. Amundson.

64. X. Zhang, D. Liu, D. Xu, S. Asahina, K. Cychosz, K. V. Agrawal, Y. Al Wahedi, A. Bhan, S. Al Hashimi, O. Terasaki, M. Thommes, M. Tsapatsis*, “Synthesis of Self-Pillared Zeolite Nanosheets by Repetitive Branching”, **Science**, 336, 1684, 2012.
65. H. Zhang, W. J. Suszynski, K. V. Agrawal, M. Tsapatsis, S. Al Hashimi, L. F. Francis*, “Coating of Open Celled Foams”, **Industrial & Engineering Chemistry Research**, 51, 9250, 2012.
66. J. A. Stoeger, M. Palomino, K. V. Agrawal, X. Zhang, G. N. Karanikolos, A. Corma, M. Tsapatsis*, “Oriented CoSAPO-5 Membranes by Microwave-Enhanced Growth on TiO₂-Coated Porous Alumina”, **Angewandte Chemie International Edition**, 51, 2470, 2012.
67. K. V. Agrawal, X. Zhang, L. F. Francis, M. Tsapatsis, “Fabrication of thin zeolite membranes using exfoliated zeolite nanosheets”, **Procedia Engineering**, 44, 198-199, 2012.
68. K. Varoon (Agrawal), X. Zhang, B. Elyassi, D. D. Brewer, M. Gettel, S. Kumar, J. A. Lee, S. Maheshwari, A. Mittal, C. Y. Sung, M. Cococcioni, L. F. Francis, A. V. McCormick, K. A. Mkhoyan, M. Tsapatsis*, “Dispersible Exfoliated Zeolite Nanosheets and Their Application as a Selective Membrane”, **Science**, 334, 72, 2011.
 - Featured in runner-up in **breakthrough of the year, 2011** by the Science Magazine.
69. K. Kahali, K. Varoon (Agrawal), J. Bellare*, “Preparation of Lacey Polymer Film as Efficient Specimen Supports for TEM and Cryo-Transmission Electron Microscope (Cryo-TEM)”, Proceedings of XXVII Annual Meeting of EMSI and Conference on Electron Microscopy and Allied Fields, April 1-3, 150-151, 2004.

Book Chapter

L. Bondaz, S. Huang, M. Rezaei, S. Li, K. V. Agrawal, “Nanoporous Single Layer Graphene Membranes for Gas Separation”, in Liu, Jin (Eds.): Two-Dimensional-Materials-Based Membranes. Preparation, Characterization, and Applications. Wiley. 2022.

Patent and Patent Applications

1. “Method of functionalizing graphene nanopores”, K. V. Agrawal and K.-J. Hsu, European Patent Application EP22206687 (2022).
2. “Method of preparing two-dimensional metal-organic frameworks films”, K. V. Agrawal, M. Tsapatsis, Q. Liu, US Patent Application 63/425025 (2022).
3. “Method of preparation of porous polymeric support layer and uses thereof”, K. V. Agrawal, D. J. Babu, and L. F. Villalobos, European Patent Application EP20174809 (2021).
4. “New process for graphene membranes lattice engineering and uses thereof”, K. V. Agrawal, S. Huang, K.-J. Hsu, European Patent Application EP20166877 (2021).
5. “Hybrid membranes for energy-efficient carbon capture”, K. V. Agrawal and G. He, International Patent Application WO/2020/011892.
6. “Graphene membrane filter for gas separation”, K. V. Agrawal, S. Huang, US Patent 11559772B2 (2023)
7. “Ultrahigh flux gas-selective nanoporous carbon membrane and manufacturing method thereof”, K. V. Agrawal, M. Dakhchoune, S. Huang, G. He, N. Dudani, International Patent Application WO/2018/177533.
8. “Crystalline poly(triazine imide) membranes and uses thereof”, K. V. Agrawal, L. F. Villalobos, International Patent Application WO/2021/074401.
9. “Silica Support Structure for a Zeolite Membrane”, M. Tsapatsis, K. V. Agrawal, L. F. Francis, US Patent US10005674 (2018).
10. “Zeolite Nanosheet Membrane”, US Patent US10005077 (2018).

11. "Method for Assessment of Friction Properties of Fibers or Substrates upon Mechanical Treatment", C. K. Yagnik, K. Varoon (Agrawal), US8429963 (2013).
12. "Method for Assessment of Electrostatic Properties of Fibers or Substrates", K. Varoon (Agrawal), US Patent US8198901 (2012).

Invited Lectures at International Conferences

1. Gordon Research Conference (GRC) on Nanoporous Materials and Their Applications, USA, 2023.
2. Keynote talk in GBT-SPT 2023 and 2nd GBA-MMP Symposium, 2023.
3. International Nanofluidic Symposium, Singapore, Jan 18-20, 2023.
4. 11th International Membrane Science and Technology Conference (IMSTEC2022), Melbourne, 2022.
5. 16th International Conference on Inorganic Membranes (ICIM 16), Taiwan, 2022.
6. Materials Research Society (MRS) Spring Meeting, Honolulu, May 2022.
7. Plenary talk (FRI/John G. Kunesh Award), Separation Division, AIChE Annual Meeting 2021, USA.
8. KAUST Research Conference: Advanced materials for energy-efficient separations, Addressing Vision 2030 and beyond, Saudi Arabia, 2020.
9. Summer School by European Membrane Society, University of Edinburgh, Scotland, 2019.
10. GRC on "Membranes: Materials and Processes", USA, 2018.
11. Young Membrane Scientist Award lecture, North American Membrane Society (NAMS), USA, 2018.

Invited Lectures (others)

12. Seminar, Ohio State University, Fall 2023.
13. Seminar, Yonsei University, Jan 2023.
14. Invited talk in the thematic session, "Membranes for Gas Separation" in the workshop "Thin Film Nanostructured Membranes for Gas Separation, Storage and Water Desalination" at IISC Bangalore, India, Jan 2022.
15. Seminar, University of Minnesota, Jan 2022.
16. Seminar, ETH Zurich, 2021.
17. Seminar, Georgia Institute of Technology, 2021.
18. Seminar, John Hopkins University, 2021.
19. Seminar, University of Texas at Austin, 2021.
20. Research Talk, Swiss Parliament Committee for Science, Education and Research, Sion, Switzerland, 2021.
21. Research Talk, ETH Board, Sion, Switzerland 2021.
22. Young Faculty Meeting, Swiss Chemical Society, Bern, Switzerland, 2021.
23. EuroTech Seminar Series, 2021.
24. Seminar, Indian Institute of Sciences, Bangalore, 2021.
25. Research Talk, Extended EPFL Energy Event: Carbon capture, utilization and storage, 2021.
26. Seminar, National Graphene Institute, Manchester, UK, 2021.
27. Seminar, IBM Research Center, Brazil, 2021.
28. Seminar, Graphene Center, Cambridge University, 2021.
29. Seminar, Separation Technology Workshop, Yonsei University, 2021.
30. Research Talk, EPFL Alumni Day, 2020.
31. Seminar, ExxonMobil Research and Engineering, Clinton, USA, 2019.
32. Seminar, Stockholm University, Sweden, 2019.
33. Seminar, Eidgenössische Materialprüfungs- und Forschungsanstalt (EMPA), Switzerland, 2019.
34. Seminar, Imperial College London, UK, 2018.
35. Seminar, Massachusetts Institute of Technology, Boston, USA, 2018.
36. GAZNAT Global gas conference, EPFL, Lausanne, 2018.
37. Seminar, Indian Institute of Technology, Bombay, India, 2018.

38. Raman Microscopy Workshop, ETH Zurich, Switzerland, 2017.
39. Seminar, Czech Academy of Sciences, Czech Republic, 2017.
40. Inorganic Chemistry Seminar, University of Bayreuth, Germany, 2017.
41. Chemical Engineering Seminar, Indian Institute of Science, Bangalore, India, 2016.
42. Chemical and Biological Engineering seminar, University of Wisconsin-Madison, USA, 2015.
43. Chemical & Biological Engineering seminar, Northwestern University, Evanston, USA, 2015.
44. Special Chemical Engineering Seminar, Purdue University, West Lafayette, USA, 2015.
45. Chemical & Biochemical Seminar, Rutgers University, New Jersey, USA, 2015.
46. Memento ISIC Seminar, EPFL, Switzerland, 2014.
47. Seminar, Massachusetts Institute of Technology, Boston, USA, 2014.
48. CEMS Advanced Doctoral Student Seminar, University of Minnesota, Minneapolis, USA, 2013.

Project Funding (raised ~21 million CHF for the following projects)

- EPFL Solutions4Sustainability Grant (2023).
- EPFL-UNIL Climact Grant (2023).
- EPFL FSB Strategic Grant (2022).
- Bridge Proof of Concept Grant with Dr. Mojtaba Rezaei (2022-2023).
- 2022 EPFL FSB Science Seed Grant (2022-2023).
- GAZNAT precombustion carbon capture project (2021-2024).
- Postcombustion carbon capture demonstration project (funded by GAZNAT and Swiss Federal Office of Energy; 2020-2025).
- Advanced in situ TEM for atomic-scale material chemistry and engineering (2020).
- District demonstrator project (funded by Valais administration, Switzerland; 2020-2025).
- Shell postcombustion carbon capture project (2020-2023).
- Swiss National Science Foundation Project (2020-2024).
- Swiss National Supercomputing Center (2019-2020).
- ABB research grant (2019).
- GAZNAT carbon capture project - Phase II (2019-2023).
- Swiss National Supercomputing Center (2018-2019).
- European Research Council (ERC) Starting grant (2018-2022).
- Cooperation and Development Center (CODEV) seed grant (2018).
- Swiss National Science Foundation Assistant Professor Energy grant (2017- 2020).
- GAZNAT carbon capture project (2017-2020).
- Swiss Competence Center of Energy Research – Efficiency in Industrial Processes (SCCER-EIP), Phase II (2017 – 2020).
- EPFL Valais funding on exfoliation chemistry (2017-2020).
- ETH-Board funding on collaborative energy research (2016-2017).

Awards and Academic Honors

1. FRI/John G. Kunes Award, AIChE Separation Division, 2021.
2. Young Membrane Scientist Award, North American Membrane Society (NAMS), 2018.
3. European Research Council (ERC) Starting Grant, 2018.
4. Swiss National Science Foundation Assistant Professor Energy Grant (Career Grant, 2017).
5. Best Poster Award, Gordon Research Conference on Nanoporous Materials and Their Applications, 2015.
6. Graduate Student Research Award, AIChE Separations Division, 2013.
7. Doctoral Dissertation Fellowship (2012-2013), University of Minnesota.
8. Sigma Xi Award for best student poster presentation during DDF showcase.
9. Best Poster Award, Gordon Research Conference on Nanoporous Materials and Their Applications, 2011.
10. CEMS Outstanding Teaching Assistant Award (2009-2010), University of Minnesota.
11. Procter & Gamble R&D Vice President Power of You Gold Award.

12. Institute Silver Medal for securing 1st rank in Department of Chemical Engineering at IIT Bombay.
13. Manudhane Best Undergraduate Student Award for overall excellence at IIT Bombay.
14. IIT Bombay Merit Scholarship (2003-2005).

Professional Activities outside EPFL

1. Early Career Editorial Board Member of Separations & Purification Technology (2023-24).
2. Early Career Editorial Board Member of Journal of Membrane Science (2020 onwards).
3. Member of the GAZNAT Steering Committee for Carbon Capture (2020 onwards).
4. Guest Editor, "Separation and Purification Technology" for the special issue on "Two Dimensional Membranes"
5. Member of the Swiss Steering Committee for Swiss-Norwegian Beamlines (SNBL, 2021 onwards).

Professional Activities within EPFL

1. Member of the EPFL Vision Committee for CO₂ Sequestration (2022).
2. Member of the ISIC Physical Chemistry Faculty Hiring Committee (2021-2023).
3. Member of the EPFL Valais Wallis Campus Committee (2021 onwards).
4. Scientific Advisor to the EPFL Student Team on Direct Air Capture (2021 onwards).
5. Member of the Doctoral School Committee (EDCH), Institute of Chemical and Engineering Sciences (ISIC, 2020 onwards).
6. Chair of the EPFL Valais Faculty Committee (2018-2020).
7. Member of the ISIC Vision Panel (2019).
8. Member of several ISIC Hiring Committees for NMR Platform Scientist (2019).
9. Member of the SCGC Teaching Committee (2016-2017).

Organization of Conference

1. Conceptualized, organized, and raised funding through sponsor (Chevron) for the Graduate Student Award Session in AIChE Material Engineering and Sciences Division, Inorganic Materials.
2. *Area Chair* (Inorganic Materials, Material Engineering and Sciences Division, MESD), AIChE Annual Meeting, Pittsburgh, USA, 2018
3. Chair for multiple sessions at AIChE annual meeting 2021.
4. Session Chair, 12th International Congress on Membranes and Membrane Processes (ICOM 2020).
5. Chair, Synthesis and Application of Inorganic Materials II: Application/Separations, AIChE Annual Meeting 2020 (online).
6. Co-chair, Inorganic Materials Graduate student award session, AIChE Annual Meeting, 2020 (online).
7. Co-chair, Two-Dimensional Materials and Thin Films, AIChE Annual Meeting, 2020 (online).
8. Chair, Inorganic Materials, North American Membrane Society 2020 (online).
9. Chair, Graduate student award session (area: MESD Inorganic Materials), AIChE Annual Meeting, Orlando, USA 2019
10. Chair, Graduate student award session (area: MESD Inorganic Materials), AIChE Annual Meeting, Pittsburg, USA 2018
11. Chair, MOFs, COFs, and Porous Polymer Materials I: Synthesis, AIChE Annual Meeting, Minneapolis, USA, 2017
12. Chair, MOFs, COFs, and Porous Polymer Materials II: Applications, AIChE Annual Meeting, Minneapolis, USA, 2017
13. Chair, Nanostructured Thin Films, AIChE Annual Meeting, San Francisco, USA, 2016
14. Co-Chair, Advances in the Synthesis and Application of Porous Materials I, AIChE Annual Meeting, San Francisco, USA, 2016
15. Chair, Advances in the Synthesis and Application of Porous Materials II, AIChE Annual Meeting, Salt Lake City, USA, 2015
16. Participant, Department of Energy's Advance Manufacturing Office Workshop on Membrane Technology, Chicago, USA, 2012

Professional Affiliations

Member of Royal Society of Chemistry (MRSC), Swiss Chemical Society, Swiss Process & Chemical Engineers, European Federation of Chemical Engineering, American Institute of Chemical Engineers, American Chemical Society, Material Research Society, European Membrane Society, North American Membrane Society, American Association for The Advancement of Science

Reviewer

Grant proposals: Horizon 2020 (European Research Council Starting Grant), ACS PRF

Journal Articles (~40 per year)

Science, Nature, Nature Materials, Nature Nanotechnology, Nature Energy, Advanced Materials, Science Advances, Proceedings of National Academy of Sciences, Nature Communications, Journal of American Chemical Society, Angewandte Chemie, Advanced Functional Materials, Nano Letters, ACS Nano, ACS Applied Materials and Interfaces, Carbon, ACS Applied Nano Materials, ACS Applied Polymer Materials, Chemistry-A European Journal, Chemical Reviews, ACS Sensors, The Journal of Physical Chemistry Letters, Journal of Membrane Science, Journal of Materials Science, Nano Research, The Journal of Physical Chemistry-C, Microporous and Mesoporous Materials, Industrial and Engineering Chemistry Research, ChemPhysChem, Journal of Chemical Technology & Biotechnology, AIChE Journal, Chemical Engineering Science.

- Industrial and Engineering Chemistry Research Excellence in Review Award - 2022

Teaching Experience

Lecturer ChE 310: Fundamentals of Separation Processes, EPFL, 2018- Present

Lecturer ChE 402: Diffusion and Mass Transfer, EPFL, 2018 - Present

Project Coach, "ChE 413: Chemical Product Design", EPFL, 2016 – Present

Kaufman Teaching Certificate Program, MIT, 2016

Guest Lectures

Fall 2009 'Absorption, Adsorption and Extraction', CHEN 2001, University of Minnesota

Spring 2012 'Structure of Zeolites', CHEN 8501, University of Minnesota

Fall 2015 'Nanoporous Membranes: Zeolite and Graphene', 10.585, Massachusetts Institute of Technology