

Curriculum Vitae

RAKESH AGRAWAL

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Education:

Sc.D. Massachusetts Institute of Technology, 1980 (Ch.E.)
M.Ch.E. University of Delaware, 1977
B. Tech. Indian Institute of Technology, Kanpur, India, 1975

Professional Experience:

- Winthrop E. Stone Distinguished Professor, School of Chemical Engineering, Purdue University. (2004-Present)
- Faculty Affiliate, Division of Environmental and Ecological Engineering, Purdue University (2011 - Present)
- Director, Solar Economy Integrative Graduate Education and Research Traineeship (IGERT) Center. (2009-2016)
- Director, Sustainable Food, Energy and Water Systems Center, an NSF NRT Center (2017-Present)
- Visiting Professor, Ecole Polytechnique Federale de Lausanne, Switzerland, (Sept 2010, May – June 2018).
- Visiting Scientist, Helmholtz-Zentrum Berlin für Materialien und Energie, Berlin, Germany (Oct 2010-Feb. 2011).
- ExxonMobil Visiting Chair Professor, Department of Chemical and Biomolecular Engineering, National University of Singapore, (2011-2014).
- Fellow of the Hagler Institute for Advanced Study at Texas A&M University (2014-2015).
- Visiting Professor, University of Melbourne, Melbourne, Australia, (January- February 2018)
- Visiting Scientist, National Renewable Energy Laboratory (NREL), Golden, CO (March – April 2018).
- Guest Professor, Tianjin University, Tianjin, China (2018-2020)
- Distinguished Adjunct professor, Institute of Chemical Technology, Mumbai, India (2019-2021)

Air Products and Chemicals, Inc., Allentown, USA. (1980-2004)

2003-2004 *Air Products Fellow (The highest technical position at Air Products)
Chair, Air Products' Technology Board
Participating Member, Air Products' Technology Executive Team.*

1980-2003 *Process Engineer, Principal Research Engineer, Senior Principal Research Engineer, Lead Research Engineer, Process Manager, Senior Engineering Associate, Principal Engineering Associate; Chief Engineer.*

Managerial Experience:

At Air Products, supervised and coordinated teams of about a dozen chemical engineers; provided technical leadership in the areas of gas separation and gas liquefaction; provided linkages between research, development, process, and business groups; supported technical sales; prepared R&D budgets and planned long and short-term R&D projects. Established a state-of-the-art Process Synthesis group for separation process evaluation, development, and commercialization.

Instrumental in developing and driving Air Products' "New Waves" document that set out some major growth opportunities for Air Products based on the emerging social and technological trends and many of the opportunities were implemented.

Research Interests:

Solution-processed electronic devices including solar cells; Nanoparticle synthesis and use; Energy systems analysis; Energy transformation and use issues for solar, natural gas, coal, biomass, and hydrogen economy; PV-Aglectric Farming (Agrivoltaics); Novel separation processes using distillation, membranes, and adsorption; Process development; Cryogenics and gas liquefaction processes.

Patent Activities:

- One hundred and thirty-one U. S. patents; nearly five hundred non-U.S. patents; and seven pending US Patent Applications.
- The patented ideas have been applied to over 100 operating plants with total capital investments of multi-billion dollars.

Publications and Presentations:

- Two hundred Fifty-seven technical papers (One hundred ninety-one in refereed journals, six book chapters).
- Two hundred fifty-one technical presentations and two hundred seventy-nine invited lectures.
- Co-author of ten annual technology symposium papers. This is a prestigious proprietary annual symposium at Air Products and Chemicals.

Professional Societies:

- Fellow, American Institute of Chemical Engineers (AIChE),
- Fellow, American Academy of Arts and Sciences (AAAS),
- Fellow, Indian National Academy of Engineering (INAE),
- Fellow, National Academy of Inventors (NAI).
- Member, U.S. National Academy of Engineering (NAE);
- Member, American Chemical Society (ACS),
- Member, Institute of Electrical and Electronic Engineers (IEEE),
- Member, Material Research Society (MRS),
- Member, Sigma-Xi

Professional Service:

1. National:

Industrial Technical Advisory Boards:

- Member, Technology Board, Air Products and Chemicals (2004-2007)
- Member, Technical Advisory Board, Dow Chemical (2007- 2014)
- Member, Technical Advisory Board, Kyrogen Ltd. (2007-2010)
- Member, Technical Advisory Board, Weyerhaeuser (2008- 2009)
- Member, Engineering Advisory Board, Genomatica (2009 - 2013)
- Member, Technical Advisory Board, ATMI (2010-2012)
- Member, Aspen Tech Academy, Aspen Tech (2012 - 2017)

Academic Advisory Committees:

- Advisory Council member, School of Chemical and Biochemical Engineering, Cornell University (2002-2007)
- Member, Bourns College of Engineering Council of Advisors, University of California, Riverside (2003 – 2005)
- Chemical Engineering Department Advisory Committee member, Worcester Polytechnic Institute, Worcester, MA (2007- 2012)
- Member, Wanger Institute for Sustainable Energy Research (WISER) Board of Advisors, IIT Chicago (2009-)
- Member, Department of Chemical and Biomolecular Engineering Advisory Council, University of Delaware (2012-)
- Member, Department of Chemical and Biomolecular Engineering Advisory Council, Lehigh University (2016- 2020)
- Member, Penn State Chemical Engineering External Review Committee, University Park, PA, 2019.

National Lab Advisory Panel:

- Member, Technical Review Panel for the Materials and Chemicals Science & Technology Directorate, National Renewable Energy Lab (NREL), Golden, CO, (2019-Present)

U.S. National Academy of Engineering (NAE):

- Member, Peer Committee, Chemical Engineering Section (2004-2007)
- Member, Nominating Committee (2005)
- Vice Chair, Chemical Engineering Section, NAE (2011)
- Chair, Chemical Engineering Section, NAE (2012)
- Participant, National Academy of Engineering (NAE) workshop on ‘Educate to Innovate’, Washington DC, October 2013
- Member, Committee on Membership (CoM) (2017-2020)
- Member, NAE Energy Working Group, (2021-)
- National Research Council (NRC):
 - Member, NRC Board on Energy and Environmental Sciences (BEES) (2005-11)
 - Member, Committee on Alternatives and Strategies for Future Hydrogen Production and Use (2002-2004)
 - Workshop participant, NRC Committee on Novel Approaches to the Management of Greenhouse Carbon (2003)
 - Member, NRC Panel on Fuel Cell Research (2004)
 - Member, NRC Panel on DOE’s Integrated Gasification Combined Cycle R&D Program (2005)

- Member, NRC Committee on Assessment of Resource Needs for Fuel Cell and Hydrogen Technologies (2006-2008)
- Member, National Academies' Renewables Panel for the Committee on America's Energy Future (2007-2008)
- Participant, NRC planning meeting for a Carbon Summit (2009)
- Member, NRC Committee on Plug-in Hybrid Electric Vehicles (PHEV) (2009-2010)

American Institute of Chemical Engineers (AIChE):

- Member, AIChE Board of Directors (2006-2008)
- Chemical Engineering Technology Operating Council (CTOC): Member (1999-2007), Vice Chair, and then Chair (2001-2002)
- Member, AIChE Awards Committee (1999-2003)
- Member, Publications Quality Team (1995 - 1996)
- Member, AIChE Energy Commission (2005-2007)
- Member, Search Committee for AIChE Journal's Chief-Editor (2000)
- Participant, AIChE Board's Strategy Planning Meeting (2004)
- Member, AIChE Fellow Review Committee (2006 – 2008)
- Member, AIChE Board Award Committee (2008)
- Member, AIChE International Committee (2008 – 2009)
- Member, Board of Trustees AIChE Foundation (2011)
- Separations Division: Second Vice Chair to Chair and then Past Chair (1993-1995), Awards Committee Member (1992-1994), and Publications Committee Co-Chair (1992-1994).

Editorial Boards:

- Consulting Editor, Separations, AIChE Journal (1999 - 2008)
- Member, Editorial Advisory Board, Industrial & Engineering Chemistry Research (2010-2012)
- Member, Editorial Board, Current Opinion in Chemical Engineering (2011- 2021)
- Member, Editorial Advisory Board, Chemical Engineering Progress (2012- 2020)
- Member, Consulting Editors Board, AIChE Journal (2012-)
- Member, Editorial Board, Chemie Ingenieur Technik - Chemical Engineering and Technology – Energy Technology (2012- 2023)
- Editorial Board member, Journal of Advanced Manufacturing and Processing (2018-Present)

Industrial Consultancy: Air Products and Chemicals (2004- 2014)

Workshop and Conferences:

- Chair, AIChE's 2nd Topical Conference on Separations (1995)
- Organizing Committee Member, Fifth International Conference on Foundations of Computer-Aided Process Design (FOCAPD) (1999)
- Co-Chair, 12th Intersociety Cryogenic Symposium in Atlanta (2000)
- Chair, Gordon Research Conference on Separation and Purification (2000)
- Co-chair, Sixth FOCAPD Conference, Princeton (2004)
- Co-chair, National Science Foundation (NSF) Workshop on 'Separations Research Needs for the 21st Century', (2004)
- Participant, U.S. Department of Energy's workshop on Separations, Austin, TX (2005)
- Member, Technical Advisory Committee, FOCAPD (2009)
- Member, International Programming Committee, 8th International Conference on Foundations of Computer-Aided Process Design (FOCAPD 2014), Seattle, WA (2014)
- Member, International Program Committee, Process Systems Engineering, PSE 2018, San Diego, July 2018

- Member, International Programming Committee (IPC), Foundations of Computer Aided Process Design (FOCAPD) 2019
- Member, International Scientific Committee (ISC), Foundations of Computer Aided Process Design (FOCAPD) 2024, Breckenridge, Colorado

Miscellaneous:

- Trustee CACHE Corporation (1997 - 2005)
- Member, Department of Energy's (DOE) Hydrogen Merit Review Panel, NETL, Pittsburgh (2003, 2004, and 2007)
- Member, NSF Panel on Process Design and Control (2005)
- Panel member, The H-Prize, Panel chaired by the U.S. Representative Bob Inglis, Chairman of the Science Research Subcommittee, U.S. Congress (2005)
- Member, NSF Panel on Separations (2006)
- Team Member for the NSF international benchmarking study on Systems Engineering for Renewable and Clean Energy Manufacturing (SEEM), (2012)

2. International:

International Institute of Refrigeration (IIR):

- U.S. member, Commission A3 (1996-1999)
- U.S. member, Commission A2 (2000-2007)
- Vice President of Commission A2 (2003-2007)
- Review Committee Member, International Dictionary of Refrigeration, IIR (2001-2003)

Academic Advisory Boards:

- Member, Advisory Board, Department of Sustainable Engineering, IIT Kanpur, India (2021-Present)

Industrial Consultancy:

- Consultant for the project 'Establishment of an Integrated Model Farm Utilizing Modern Technologies for Local Agricultural Commodities in Kuwait', Kuwait Institute for Scientific Research (KISR), Kuwait, 2019

Workshop and Conferences:

- Technical Committee Member, IChemE's Distillation and Absorption '97 Conference (1995 - 1997)
- Member, International Advisory Committee, Joint IChE, and AIChE conference, Mumbai, India (2004)
- Co-chair, Energy Workshop at the Joint IChE and AIChE conference, Mumbai, India (2004)
- Member, Scientific Committee, Distillation & Absorption (2006)
- Member, International Scientific Committee, Distillation & Absorption (2010)
- Member, International Program Committee, ESCAPE-21, Greece (2011)
- Member, Scientific Committee, 10th International Symposium on Process Systems Engineering, PSE'09, Brazil (2009)
- Member, Scientific Committee, Distillation & Absorption-Conference 2014 in Friedrichshafen, Germany (2014)
- Member, Scientific Committee, 7th International Symposium on Feedstock Recycling of Polymeric Materials (7th ISFR), New Delhi, India, October 2013
- Member, International Advisory Committee, Second International Conference on Advanced Materials for Power Engineering (ICAMPE-2016), Kottayam, Kerala, India

- Member, International Conference on Sustainable Chemical Product and Process Engineering (SCPPE), International Academic Committee, Nanjing, China, June (2016)
- Member, International Advisory Team, International Conference on Emerging Materials and Applications (ICEMA), Allahabad, India, Feb. 2017
- Member, Scientific Advisory Committee, Separations Technology IX: New Frontiers in Media, Techniques, and Technologies, Engineering Conferences International (ECI), Albufeira, Portugal, March 2017
- Member, Scientific Committee, Distillation & Absorption conference, Florence, Italy, September 2018
- Member, International Advisory Committee, Third International Conference on Advanced Materials for Power Engineering (ICAMPE), Kottayam, Kerala, India, August 2019
- Committee Member, SCPPE 2019, 5th International Conference on Sustainable Chemical Product and Process Engineering, Tianjin, China, June – July 2019
- Member, International Program Committee (IPC), 14th International Symposium on Process Systems Engineering (PSE), Kyoto (Japan), July 2022
- Member, Scientific Committee of Distillation and Absorption, Toulouse, 2022; Member, International Advisory Board, IChE-CHEMCON 2023, December, Kolkata, India

European Federation of Chemical Engineering (EFCE):

- Guest member, Working Party on Fluid Separations (2010 -)
- Member, European Federation of Chemical Engineering (EFCE) Excellence Award in Fluid Separations, (2020- Present)

Miscellaneous:

- Panel Member, Role of Indian Diaspora in Capacity Building for Affordable Solar Power, Presentation of solar strategy to Indian Prime Minister Narendra Modi, External Affairs Minister Sushma Swaraj, and Energy Minister R. K. Singh, August 2018
- Panelist, Role of Indian Diaspora in Capacity Building for Affordable Solar Power, 15th Pravasi Bharatiya Divas (PBD) Convention, Varanasi, India, January 2019
- Panelist, Sustainable Fuels, Vaishvik Bhartiya Vaigyanik (VAIBHAV) Summit, October 2020
- Panelist, Advanced Materials, Vaishvik Bhartiya Vaigyanik (VAIBHAV) Summit, October 2020

Awards and Honors:

1. National:

- National Medal of Technology & Innovation from the U.S. President Barack Obama (2011) [The highest honor given by the U.S. government for Technology and Innovation]

Honorary Memberships:

- Member, U.S. National Academy of Engineering (2002)
- Fellow, American Academy of Arts and Sciences, AAAS (2013)
- Member, U.S. National Academy of Inventors (2014)
- Fellow, American Institute of Chemical Engineers (AIChE) (2009)
- Institute for Advanced Study Faculty Fellow, Texas A&M University (2014)
- Distinguished Member, The National Society of Collegiate Scholars, NSCS (2014)
- Member, Sigma Xi (2017)

American Chemical Society:

- ACS Award in Separations Science and Technology (2017)

American Institute of Chemical Engineers:

- Institute Award for Excellence in Industrial Gases Technology (1998)
- Clarence G. Gerhold Award, Separations Division (2001)
- AIChE Institute Lecturer (2005)
- Chemical Engineering Practice Award (2006)
- Fuels and Petrochemicals Division Award (2008)
- Founders Award (2011); AIChE Alpha Chi Sigma Award (2017)
- Panelist, Meet the Innovators, AIChE (2019)

Air Products and Chemicals:

- Youngest Ever Recipient of the Air Products' Most Prestigious Chairman's Award (1992)
- Extraordinary Quality Award from Air Products and Chemicals (1992)
- Diamond Award for Inventor on One Hundred United States Patents, Air Products and Chemicals (2001)
- Air Products' Equipment Innovation Award for the AP-X™ Hybrid LNG Process (2003)

Teaching and Service at Purdue University:

- Shreve Award for Excellence in Undergraduate Teaching, (2013)
- Morrill Award, Purdue University (2014)
- Philip C. Wankat Graduate Teaching Award in Chemical Engineering, (2019)

Named Lectures at Universities:

- BAYER Lecture, Carnegie Mellon University (April 2002)
- Regents' Lecturer, University of California, Los Angeles (2004)
- Distinguished Faculty Seminar: Advanced Power Sources, University of Michigan, Ann Arbor (2004)
- W.R. Marshall Founders' Lecture, University of Wisconsin (2008)
- Tis Lahiri Lecture, Vanderbilt University (2008)
- Pirkey Lecture, University of Texas, Austin (2010)
- Hugh M. Hulbert Memorial Lecture, Northwestern University, (2011)
- Hess Lecture, University of Virginia, (2011); Ken Nobe Founders Lecture, Univ. of California, Los Angeles (2012)
- Distinguished Lindsay Lecturer, Texas A&M University, (2014)
- TIAS Eminent Scholar Lecturer, Texas A&M University (2015)
- Berkeley Lectures, Univ. of California, Berkeley (2015)
- Shinnar Lecture, Chemical Engineering Department, City College of New York, (2016)
- Distinguished WISER lecture, IIT Chicago, Chicago, IL, (2018)
- EDEY (Energy doctoral school) Distinguished Lecture in Energy, EPFL, Lausanne, Switzerland (2018)
- Distinguished Lecture of the Missouri Science & Technology Academy of Chemical Engineers, Rolla, MO, (2019)
- RENEW Innovation Lecture, State University of New York (SUNY), Buffalo, NY, (2019)
- BASF Distinguished Lecture, Wayne State University, Detroit, MI, (2022)

Miscellaneous:

- Presidential Citation for Outstanding Achievement from the University of Delaware (1995)
- Industrial Research Institute (IRI) Achievement Award (2007)
- Allan P. Colburn Honorary Lecturer, E. I. du Pont de Nemours and Company (2013)
- Inducted into Purdue Innovator Hall of Fame (2015)
- One of the Most Impactful Faculty Inventors of FY 2019, Purdue University

Honorary Listings:

- Who's Who in the World, (Marquis, 18th Edition, 2001)
- Who's Who in America
- Who's Who in Science and Engineering
- Who's Who in Finance & Business

2. International:

- Foreign Fellow, Indian National Academy of Engineering (2011)
- J&E Hall Gold Medal, Institute of Refrigeration, UK (2004)
- Honorary Fellow, Indian Institute of Chemical Engineers (2001)
- Inaugural winner of Excellence in Gas Processing Award, Annual Gas Processing Symposium, Qatar (2009)
- Distinguished Alumnus Award, Indian Institute of Technology, Kanpur (2012)
- Peter V. Danckwerts Lecture at the 10th World Congress of Chemical Engineering, Barcelona, Spain (2017)

Named Lectures at Universities:

- Professor B. D. Tilak Visiting Fellowship Lecture, Institute of Chemical Technology, University of Mumbai, India (2004)
- Annual KAIST CBE Global Distinguished Lecturer, Korea, (2013)
- Prof. C.V. Seshadri Memorial Distinguished Lecture, IIT Bombay, Mumbai, India, (2014)
- Schlumberger Lecture, DB. Robinson lecture series, University of Alberta, Edmonton, Canada, (2015)
- Spinks lecture, University of Saskatchewan, Canada, (2022)
- Chandrakanta Kesavan Lecture, Indian Institute of Technology, Kanpur, India (2022)

Named Lectures at Conferences:

- Alkyl Amines Dr. B. D. Tilak Chemcon Distinguished Speaker, Indian Institute of Chemical Engineers (IChE) (2001)
- Chemical Weekly's Padmashri Dr. G. P. Kane CHEMCON Distinguished Speaker Award, IChE (2007)
- C. K. Murthy Memorial Lecture, IChE (2008)
- Padma Vibhushan Professor M. M. Sharma CHEMCON Distinguished Speaker Award, IChE (2012)
- Solenis Bharat Ratna Professor CNR Rao CHEMCON Distinguished Lecture, IChE (2018)

Honorary Professorships:

- V.V. Mariwala Visiting Professorship, UICT, Mumbai, India (2007)
- ExxonMobil Visiting Chair Professor, Department of Chemical and Biomolecular Engineering, National University of Singapore, (2011-2014)
- Guest Professor, Tianjin University, Tianjin, China (2018-2020)
- Dr. Balwant S. Joshi Distinguished Visiting professorship, Institute of Chemical Technology, Mumbai, India (2019-2020)
- Distinguished Visiting Professor, Department of Sustainable Energy Engineering, Indian Institute of Technology, Kanpur, India (2022-)

Miscellaneous: Lecture on 'Energy Systems Analysis' voted as the best presentation at the Pan American Institute (PASI) workshop, Argentina (2008).

Former MS Students:

- Ankita Jain,
- Jeff Chen,
- Chinmay Joglekar,
- Bethlehem Negash,
- Robert Boyne (Micron),
- Wasuu Peter Oladipupo (Purdue)

Former Ph.D. Students:

- Easa Al-Musleh (ExxonMobil),
- Essam AlRuqobah (Kuwait University),
- Joseph Andler,
- Robert Balow (NRL),
- Kevin Brew (IBM),
- Nathan Carter (Monsanto),
- Jose Adrian Chavez Velasco (Hugh-Baker, Mexico),
- Zewei Chen (ExxonMobil),
- Harshavardhan Choudhari (Shell),
- John Degenstein (Three Cities Research),
- Swapnil Deshmukh (Lam Research),
- Ryan Ellis (Abbvie),
- Grayson M. Ford (Lam Research),
- Piotr Gawecki (Shell),
- Emre Gençer (MIT),
- Arun Giridhar (Purdue),
- Brian Graeser,
- Qijie Guo (DuPont),
- Charles Hages (University of Florida),
- Xianyi Hu (Intel),
- Joshua Huff (Marathon Petroleum),
- Zheyu Jiang (Oklahoma State),
- Mahaprasad Kar (ExxonMobil),
- Mark Koeper (Intel),
- Yiru Li (Sinopec),
- Gautham Madenoor Ramapriya (ABB Bangalore),
- Dharik Mallapragada (MIT),
- Tony J. Mathew,
- Scott McClary (Sandia National Lab),
- Steven McLeod,
- Dhairya Mehta (Shell),
- Caleb Miskin (ASM),
- Hye -Yeon Park (Samsung),
- Rugved Pathare (ExxonMobil),
- Taufik Ridha (ExxonMobil),
- David Rokke (Advance Materials),
- Vishesh H. Shah (Reliance, India),
- Eric Sheets (Johnson Matthey),
- Anirudh Shenvi (Consultant, India),
- Navneet R. Singh (Bayer),
- Radhakrishna Tumbalam Gooty (NETL),
- Vinod Venkatakrishnan (Shell),

- Bryce Walker (Intel),
- Kyle Weideman (Aquatech International),
- Wei-Chen (David) Yang (NIST),
- Sara Yohe (ExxonMobil),
- Ruihong Zhang (Intel),
- Xin Zhao (Apple).

Current Ph.D. Students: Shubhanshu Agarwal, Juan Alban Dominguez, Shuaikang Du, Daniel Hayes, Ana Murray, Akash Nogaja, Apurva Pradhan, Edwin Rodriguez, Robert Spilker, Ryan Swope, Jonathan Turnley, Varsha, Kiruba Catherine Vincent

Postdoctoral Associates:

- J. H. Moon (S. Korea),
- V. Bhat (India),
- U. Nallasivam (India),
- A. Smeltz (United Technology),
- H. Zhang (ExxonMobil, Singapore),
- Caleb Miskin (ASM),
- Parham Mobed (Aspen Tech),
- Brian Graeser,
- Shreyash Hadke (North Western University).