Brief Bio Sketch of Professor Abbas Firoozabadi

Abbas Firoozabadi has published some 180 Journal papers in petroleum interfaces, thermodynamics of hydrocarbon reservoirs and production, and multiphase-multispecies flow in permeable media. He has published mainly in the Society of Petroleum Engineers (SPE) Journals, AIChE Journal, Journal of Chemical Physics, Journal of Physical Chemistry B and C, Langmuir, Water Resources Research, Advances in Water Resources, Soft Matter, and Journal of Computational Physics. He has authored a graduate text, "Thermodynamics of Hydrocarbon Reservoirs," published by McGraw Hill in 1999. An extensively revised and expanded version with a new title will become available in late in 2014. Firoozabadi is the most published author in petroleum engineering in comparison to faculty members and scientists in petroleum engineering in the US. He has two patents, one related to wettability alteration to intermediate gas wetting, and another patent on anti-agglomeration of hydrates.

Firoozabadi's major contributions include theoretical, experimental and advanced computational methods in thermodynamics, and kinetics of flow assurance in hydrocarbon energy production. His current research focus includes higher-order numerical models to allow accurate evaluation of CO_2 subsurface injection. In the last several years he has focused on nano-technology and change of molecular structure in oil and gas production. He has directed research efforts and provided insight in three of the potentially world largest scale CO_2 injection projects. Firoozabadi has recently expanded his research into shale gas mostly based on molecular modeling.

Firoozabadi has received four of the five major awards of SPE. These awards include the SPE/AIME Anthony Lucas Gold Medal (highest technical award), the SPE Honorary Membership Award, and the SPE John Franklin Carll Award, in recognition of setting the stage and new directions for petroleum production and environmental stewardship of hydrocarbon energy production. In 2014, the paper by the group on CO_2 injection in oil-saturated rocks was selected for the SPE Cedric K. Ferguson award. He was elected to the National Academy of Engineering in 2011.

Major Contributions

Firoozabadi established his research consortium in 1990. It has evolved as the most productive Joint Industry Project (JIP) in petroleum engineering in comparison to a single faculty project in the United States. From the interactions with various energy, energy service, and specialty chemical companies, critical issues of hydrocarbon energy production and environmental stewardship are abstracted and then attacked in a focused and unified approach unique in the modern petroleum industries. Nearly all major oil, oil service, and specialty chemical companies including ExxonMobil (from US), Saudi Aramco (from Saudi Arabia), Petrobras (from Brazil), Schlumberger (from UK office), Japex (from Japan), and Lubrizol (from US) and some 12 other companies support his research in addition to federal and other research agencies. As a result of the unique interactions which he has enjoyed with the scientists and engineers of the energy and chemical industries, important issues of real-world problems of hydrocarbon reservoirs and production such as non-equilibrium and irreversible phenomena and kinetics, which in the past seemed extremely complicated, have been resolved and formulated. A major dimension of Firoozabadi's research and his research consortium is the use of a unified approach for the study of different types of problems. As an example, wettability in hydrocarbon reservoirs, hydrate kinetics in pipelines, and kinetics of CO_2 sequestration in oceans are all studied using concepts from surface thermodynamics. A second example is the successful application of the potential theory for the study of the gravitational potential variation of the sun and the moon for the estimation of in-situ compressibility and permeability of hydrocarbon reservoirs, and the measurement electrophoretic mobility of asphaltene particles for studying asphaltene precipitation in production facilities and pipelines. Another example is the use of irreversible thermodynamics for the prediction of composition variation in the vertical and horizontal direction in hydrocarbon reservoirs, the deposition of wax in pipelines, and the effect of diffusion in gas injection in fractured petroleum reservoirs, and gas recycling in fractured gas condensate reservoirs. The recent work on development of working equations for the simultaneous measurement of molecular and thermal diffusion coefficients in non-ideal multicomponent mixtures using laser beams of different wavelengths is another example of emphasis on fundamentals and modern techniques to solve complex problems of importance in energy production and environmental stewardship.

Dr. Firoozabadi has served as a consultant to several major oil and chemical companies in the US, Europe, Japan, and South America. In addition to advanced consulting, Abbas has made tireless appearances and given numerous lectures at technical meetings in the US and abroad, and has frequently visited and lectured at nearly all the upstream technology centers of oil companies throughout the world to transfer advanced technology to the petroleum production industry. In addition to giving graduate seminars at the Petroleum Engineering Departments of Stanford University, University of Texas-Austin, Texas A&M University, Tulsa University, Norwegian University of Science and Technology, Delft University of Technology, he has also given graduate seminars at Cambridge University, University of Tokyo, Imperial College London, MIT, Rice University, Princeton University, University of Michigan-Ann Arbor, Yale University, University of Maryland, Peking University, Tsinghua University, Waseda University, and the King Abdullah University of Science and Technology (KAUST) and a number of

other US and European universities on the effectiveness of irreversible and non-equilibrium thermodynamics in formulation and solution of problems in hydrocarbon reservoirs and production.

Professor Firoozabadi has developed and taught various courses in chemical and petroleum engineering in Iran, advanced gas engineering at Stanford University, advanced thermodynamics at the University of Texas-Austin, at Imperial College London, and at Yale University in New Haven. He has also taught intensive advanced courses on thermodynamics (for many years together with Professor Prausnitz of the University of California-Berkeley) and gas engineering at the Norwegian University of Science and Technology in Trondheim, Campinas State University in Brazil, Curtin University of Technology in Australia, and the Autonomous University of Mexico (UNAM). A survey of the advanced gas engineering course by 15 Stanford graduate students was valued at the 95th percentile at Stanford's School of Engineering. He has supervised the research work of ten Ph.D. students. His past PhD students have positions at IMP (Mexico), University of Wyoming, Texas A&M University, ExxonMobil, Chevron, and Halliburton. He is currently advising three Ph.D. students at Yale University. He has supervised a large number of post docs in the last 22 years. His recent post docs have positions at Shell, Schlumberger, ConocoPhillips, Eni, Chevron, University of Calgary, and Stanford University.

A summary of some of his specific achievements and contributions to chemical and petroleum engineering in the areas of thermodynamics and flow in the subsurface are provided in the following.

Thermodynamics of Hydrocarbon Energy Production

1. Bulk-Phase Equilibrium Thermodynamics

Firoozabadi introduced cubic equations of state for phase behavior calculation of reservoir fluids in a 1977 SPE paper co-authored with the late professor Donald Katz of the University of Michigan. This widely cited paper set the stage for large scale compositional reservoir simulation in the oil industry. He also introduced a multisolid wax model for phase behavior calculation of wax precipitation from petroleum fluids in a 1996 AIChE Journal paper co-authored with Dr. Lira-Galeana of IMP and Professor John M. Prausnitz of the University of California, Berkeley. The widely cited work has been implemented in commercial software. The papers by Firoozabadi and coworkers on the use of a micellization model for asphaltene precipitation from crudes published in the AIChE Journal and SPE Journals have received considerable citation and have advanced asphaltene precipitation predictions. He has recently advanced phase behavior of water and CO_2 and precipitation of asphaltenes by cross-association with considerable success.

2. Efficient Computations of Phase-Split and Thermodynamic Stability Testing

The papers published in SPE, AIChE and Fluid Phase Equilibria Journals lay the foundation for robust and efficient computations of phase-split and thermodynamic stability testing and critical-point calculations in multicomponent two- and three-phase states. The use of the reduction space has allowed one to two orders of magnitude decrease in CPU time. The main feature, however, is the robustness of computations for intensive (of the order of billion) phase-split calculations for evaluation of CO_2 and other

gas injection schemes in oil reservoirs and most recently in CO_2 sequestration. The methodology has been incorporated in the new release of Eclipse, the most widely used reservoir simulation software in the world. Very recently Firoozabadi and post doc Dr. Zhidong Li have developed an extremely robust and efficient multiphase-split calculation algorithm to be published in SPE Journal.

3. Fickian and Thermal Diffusion in Multicomponent Mixtures from Irreversible Thermodynamics

Introduction and consistent formulation of diffusion flux expression for thermal, pressure and concentration gradients in multicomponent non-ideal fluids from irreversible thermodynamics are major contributions from Firoozabadi's group. Demonstration of the merit of derivation of Fickian diffusion flux expression from irreversible thermodynamics over the Maxwell-Stephen approach has introduced a major advance. The papers published in I&EC Research and AIChE Journals provide framework for measurement and interpretation of Fickian and thermal diffusion in multicomponent non-ideal fluid mixtures. Formulation has been incorporated in the VIP software from Halliburton. Papers have been widely cited by various groups of engineers, physicists and chemists. Another contribution relates to demonstration that as result of the balance between pressure, Fickian, and thermal diffusion, and convention, there may be conditions under which a heavy fluid may float on top of a light fluid and publication of actual oil field data with oil on top of gas phase.

4. Gas Hydrate Driving Force, Kinetics, and Anti-agglomeration, and Aspahltene Nano-particles

Introduction and consistent formulation of hydrate formation driving force in the hydrate literature. Use of the driving force in the nucleation rate expression and induction time. The papers published in Journals of Crystal Growth and Chemical Physics have been used to interpret hydrate kinetic data and have been singled out in recent reviews as distinct advances in hydrate kinetic modeling. Demonstration of the use of very small quantities of bio-surfactants for hydrate nano-particles in the form of slurries in the environmental stewardship of hydrocarbon production. Delayed sedimentation of asphaltene nano-particles from use of ppm level dispersants.

5. Reduction of Surface Energy of Rock Substrate and Intermediate-Gas Wetting

In 1999, Firoozabadi and coworkers introduced the idea of wettability alteration to intermediate gas wetting for subsurface rocks for the first time. A patent is shared with DuPont on the subject. Contact angles as high as 160 degrees for the water-gas-rock substrate were achieved. Since then, a number of R&D polymers have been synthesized by 3M and DuPont in collaboration with Firoozabadi's group. The energy alteration is permanent and therefore fit for application in gas wells for increased well production rate. There has been much interest in the work partly due to the need to increase natural gas production and the expectation that natural gas may become the premium fuel of the 21st century. The papers published in the SPE Journals have been well received. Pilot testing of the idea has been carried out.

6. Effect of Curvature on Saturation Pressure

Development of expressions for calculating the effect of curvature on saturation pressure and interfacial tension for non-ideal multicomponent mixtures and demonstration that saturation pressure and interfacial tension may increase or decrease due to curvature, for the first time. In single component mixtures the saturation pressure always decreases with curvature according to the Kelvin expression. The work has significant application in nucleation modeling of non-ideal multicomponent mixtures (for the study of the kinetics of condensation in the retrograde region in reservoirs and in pipelines, and in hydrate formation).

Physics and Mathematics of Subsurface Flow

1. Physics of Multiphase Flow in Fractured Media

Concepts from thermodynamics and fluid flow are combined in a unique way to introduce fracture capillary in 1990 in two SPE papers for the first time. It was also demonstrated that fracture capillary pressure can be the most important parameter in oil recovery of fractured reservoirs. Shortly after, a rigorous derivation of reinfiltration concept was presented in two SPE papers.

2. Numerical Simulation of Complex Flow Problems in Hydrocarbon Reservoirs

Definitive advance in numerical solutions to the partial diffusion equations and local equilibrium expressions for two-phase multicomponent flow in fractured and heterogeneous media. The combined discontinuous Galerkin and mixed finite element method coupled with physical concepts have allowed incorporation of physics and appropriate mathematical expressions for simulation of CO_2 injection in fractured reservoirs and in sequestration. The methodology is two to four orders of magnitude faster than the software by major oil companies, oil service companies, and national labs. For the first time, diffusion can be studied in fractured media properly. Papers published in Water Resources Research, SPE, AIChE and Advances in Water Resources Journals have set the stage for realistic modeling of CO_2 injection in complex permeable media.

3. Large Scale Proposals for Carbon Dioxide Injection

Based on significant effect of diffusion on change in flow path in fractured porous media, and large reductions in viscosity and increase in swelling, proposals have been accepted by three major oil companies for study and implementation of CO_2 injection for the purpose of improved oil recovery. All projects are very large in scope.

Abbas Firoozabadi
Reservoir Engineering Research Institute (RERI)
595 Lytton Ave., Suite B, Palo Alto, CA 94301
650-326-9259 phone, 650-472-9285 fax, af@rerinst.org e-mail

Yale University, Chemical and Environmental Engineering
Mason Lab, Room 103, New Haven, CT 06520
203-432-4379 phone, abbas.firoozabadi@yale.edu e-mail

Personal

- Married, with two children
- Born 1948: Yazd, Iran

Employment

1974-1983 National Iranian Oil Company, Iran
- Assistant Professor of Gas Engineering, Abadan Institute of Technology, Abadan, Iran, 1974-1975, 1977
- Senior Research Engineer, Tehran, Iran, 1978-1980
- Senior Researcher and Manager (founder), Petroleum Recovery Research Center, Tehran, Iran, 1980-1983

1984-1987 Stanford University, U.S.A.
- Visiting Scholar, Petroleum Engineering Department, 1984-1985
- Associate Professor (Acting), Petroleum Engineering Department, 1986-1987

1988-1989 Norsk Hydro, Norway
- Research Advisor, Exploration and Production Research Center, Bergen

1990-present Reservoir Engineering Research Institute, U.S.A.
- Founder and Senior Scientist/Director, 1990-present

Fall 1996 University of Texas, Austin
- Visiting Professor, Petroleum Engineering and Geosciences Department- taught a new graduate course on "Advanced Thermodynamics of Hydrocarbon Reservoirs".

1998-2011 Imperial College London
- Visiting Professor, Department of Earth Science and Engineering Lectures to PhD students on "Advanced Thermodynamics of Hydrocarbon Reservoirs and Production". He has supervised four PhD students at Imperial College London.

2003-present Yale University, New Haven, USA
- Adjunct Professor, Department of Chemical and Environmental Engineering He taught the graduate course "Classical and Statistical Thermodynamics" annually from 2003-2012.He has been supervising of PhD students and post docs.

Education

1970	B.S. Gas Engineering (graduated with honors), Abadan Institute of Technology, Abadan, Iran
1972	M.S. Gas Engineering, Institute of Gas Technology, Illinois Institute of Technology, Chicago, IL, U.S.A.
1974	Ph.D. Gas Engineering, Institute of Gas Technology, Illinois Institute of Technology, Chicago, IL, U.S.A.
1976	Postdoctoral Fellow, University of Michigan, Chemical Engineering Department, Ann Arbor, MI, U.S.A.

Awards and Honors

1988	Journal of Petroleum Technology, Distinguished Author Paper (Phase Behavior)
2000	Journal of Canadian Petroleum Technology, Distinguished Author Paper (Fractured Reservoirs)
2000	SPE Reservoir Engineering Award
2001	Journal of Canadian Petroleum Technology, Best Paper Award
2001	Dodge Distinguished Lecture, Yale University
2002	Anthony F. Lucas Gold Medal of SPE/AIME (highest technical award of SPE)
2004	SPE John Franklin Carll Award
2009	SPE/AIME Honorary Member Award
2010	AIChE Journal, Author of Invited Perspective Article on CO_2 Sequestration
2011	Member, US National Academy of Engineering
2012	Zandmer Distinguished Lectures, University of Calgary
2014	SPE Cedric K. Ferguson Certificate

Research Interests

Current research interests center on 1) nano-particles in flow assurance in hydrocarbon energy production from onshore and offshore fields, 2) mathematical modeling of multiphase flow in the subsurface based on higher-order methods, 3) molecular modeling of shale gas and shale light oil reservoirs, and 4) diffusion in the critical region in single component and multicomponent mixtures

Teaching Interests

Four favorite topics are: 1) thermodynamics of multicomponent non-ideal mixtures for both homogenous and heterogeneous media (micelles and microemulsion) and computation of thermodynamic stability and phase splitting, 2) thermodynamics of

thin films and interfaces related to energy production and environment, and 3) irreversible thermodynamics with emphasis on energy production and climate change, and 4) multicomponent-multiphase flow in complex permeable media. Much of the fascination with the first two topics is derived from an in-depth study of the works of Gibbs, and the extent that Gibbs' original ideas and their extension on bulk-phase thermodynamics can be used to solve many physical and computational problems in energy production and environmental stewardship. The second topic provides the basis for the understanding of interfaces and size in many properties, especially in nano-particles. Irreversible thermodynamics allows practical solution to many complex problems in the subsurface and better understanding of entropy and entropy production and various diffusion processes. Flow in permeable has most of the notions of the first three topics plus the momentum balance and unique aspects of the solution to non-linear equations.

Professional Activities

- SPE Technical Editor, 1987-2011
- SPE Journal, Board, 1998-2011
- SPE Review Chairman, 1991-1993
- Committee Member of SPE Reservoir Simulation Symposium, 1988
- Committee Member of SPE Forum on Naturally Fractured Reservoirs, 1989
- Committee Member of SPE Western Regional Meeting, 1992
- Chairman of SPE Forum on Reservoir Fluids: Phase Behavior and Physical Properties, 1993
- Committee member of SPE Annual Fall Meeting, 1994-1997
- Session Chairman - "Fractured and Heterogeneous Reservoirs," 1988 Reservoir Simulation Symposium
- Session Chairman - "Field Case Studies," 1989 SPE Forum on Naturally Fractured Reservoirs
- Session Chairman - "Fractured Reservoirs," 1992 SPE Western Regional Meeting
- Member of the SPE Long Term Strategy Committee, 2004-2006
- Member of the Scientific Committee of 2006 International Thermodiffusion Conference, IMT 7, San Sebastian, Spain
- Member of the SPE John Franklin Carll, Anthony F. Lucas Gold Medal, and the Lester C. Uren Awards Committee, 2005-2007
- Member of the AIME 2007-2009 Mineral Economics Award Committee
- Member of the SPE Major Awards Committee, 2010-2012
- Member of the Scientific Committee for the 2010 International Interdiffusion Conference, IMT9, Toulouse, France
- Member of the Scientific Committee of the 2012 International Thermodiffusion Conference, IMT10, Brussels, Belgium
- Member of NRC Shale Gas Committee, 2013

- Member of the Scientific Committee of the 2014 International Thermodiffusion Conference, Toulouse, France
- Member of NAE Membership Committee (section 11), 2014-2017

Consulting

- National Iranian Gas Company, Iran, 1975-1980
  Various studies on Iranian gas reservoirs and gas pipelines
- Oil Service Company of Iran, 1977-1980
  Various studies on Iranian fractured oil reservoirs
- Norsk Hydro, Norway, 1986-2000
  Various studies on major oil and gas reservoirs of the Norwegian North Sea.
  Studies on all fractured reservoirs of the Ekofisk field
- Japan National Oil Corporation (JNOC), Japan, 1986-1995
- Mobil Research and Development Company, Dallas, TX, U.S.A., 1987
- Amoco Production Company, Tulsa, OK, U.S.A., 1987, 1992, 1993, 1995
- Petrobras, Brazil, 1990, 1992, 1995
- Oil and Natural Gas Commission, India, 1991, 1993, 1994
  Development of Ghandahar volatile oil and gas condensate reservoirs (UN Sponsorship)
- Marathon Oil Company, Denver, CO, U.S.A., 1993
- Union Pacific Resources, Fort Worth, TX, U.S.A., 1993
- Pennzoil Exploration Co., Houston, TX, U.S.A., 1994
  Evaluation of a very tight fractured oil reservoir
- Phillips Petroleum Co., Bartlesville, OK, U.S.A., 1995
- Pemex, Mexico City, 1996
- Intevep, Caracas, 1996, 1998
- Pall Corporation, New York, 1997
  Evaluation of droplet formation in gas pipelines
- Fina Italy, Milan, 1997
  Evaluation of the Tempa Rosa fractured field
- Seven Seas Petroleum Company, Houston, 1999
  Evaluation of a tight fractured reservoir in Colombia
- Shell International, Houston, 1999
  PDVSA, Puerto La Cruz, Venezuela, 2000
- Schlumberger , Houston, 2001-2002
- Plus Petrol, Buenos Aires, Argentina, 2002
  Evaluation of a Complex Gas Condensate Field in Peru
- Chevron and Schlumberger, San Ramon, CA, 2004-2006
  Thermodynamic Computations

- Pemex, Mexico, 2004, 2006
  Evaluation of Puerto Ciba Abnormally Pressured Reservoir, 2004
  Evaluation of the Cantarell Group of Fractured Reservoirs, 2006
- Petrobras, Rio de Janeiro, 2007
  Irreversible thermodynamics and reservoir connectivity
- Petrobras, Rio de Janeiro, 2008-2011
  Carbon dioxide injection and production strategy in giant pre-salt offshore fields
- Mexican Institute of Petroleum, Mexico City, 2012
  Numerical Simulation of fractured reservoirs
- Pemex, Cd. del Carmen, 2012
  CO_2 Injection in fractured reservoirs
- Pemex, Cd. del Carmen, 2013
  Gas Condensate Reservoirs
- ExxonMobil Corporate Research, New Jersey, 2014
  Structure in Fluids

Patents

1. Gas Hydrate Inhibitors
   Mastrangelo, A., Firoozabadi, A., Sun, M., Chang, Z. US Provisional Patent Application 61/885,530, Filed by Lubrizol Corporation on October 2, 2013.

2. Prevention and Remediation of Water and Condensate Blocking in Wells
   Marin C. M., Wu, S., and Firoozabadi, A. Patent Application 12/437572
   Patent filed by DuPont.

Publications

I – Book

Firoozabadi, A.: "*Thermodynamics and Applications in Hydrocarbon Energy Production*," Spring 2015.

Firoozabadi, A.: "*Thermodynamics of Hydrocarbon Reservoirs*," McGraw-Hill, NY, New York, 1999.

II – Papers

Refereed Journals

1. Firoozabadi, A., Hekim, Y. and Katz, D.L.: "Reservoir Depletion Calculations for Gas Condensates Using Extended Analyses in the Peng-Robinson Equation of State," *Canadian Journal of Chemical Engineering* (Oct. 1978)610-615, also SPE Reprint Series No. 15 "Phase Behavior" (1981).
2. Katz, D. L., and Firoozabadi, A.: "Predicting Phase Behavior of Condensate/Crude-Oil Systems Using Methane Interaction Coefficients," *Journal of Petroleum Technology* (Nov. 1978)1649-1655, also *AIME Transactions*, Vol. 26(1978), also SPE Reprint Series No. 15 "Phase Behavior" (1981).
3. Firoozabadi, A. and Katz, D. L.: "An Analysis of High Velocity Gas Flow through Porous Media," *Journal of Petroleum Technology* (February 1979)211-216.
4. Firoozabadi, A. and Leipziger, A.: "Bubble Point Measurements for Ternary Systems Containing Nitrogen and Methane with Propane, n-Butane or n-Pentane," *Chemical Engineering Communications* (1986)46,311-321.

5. Firoozabadi, A. and Aziz, K., "Analysis and Correlation of Nitrogen and Lean Gas Miscibility Pressure," S*PE Reservoir Engineering Journal* (Nov. 1986)575-582.

6. Firoozabadi, A., Katz, D.L., Soroosh, H. and Sajjadian, V.A.: "Surface Tension of Reservoir Crude Oil-Gas Systems Recognizing the Asphalt in the Heavy Fraction," *SPE Reservoir Engineering Journal* (February 1988)265-272.

7. Firoozabadi, A., Nutakki, R., Wong, T. and Aziz, A.: "EOS Prediction of Compressibility and Phase Behavior in Systems Containing Water, Hydrocarbons and CO_2," *SPE Reservoir Engineering Journal* (May 1988)673-684.

8. Firoozabadi, A. and Ramey, H.J., Jr.: "Surface Tension of Water-Hydrocarbon Systems at Reservoir Conditions," *Journal of Canadian Petroleum Technology* (May-June 1988)41-48.

9. Firoozabadi, A., Soroosh, H. and Hasanpour, G.H.: "Drainage Performance and Capillary Pressure Curves Utilizing a New Centrifuge," *Journal of Petroleum Technology* (July 1988)913-919.

10. Firoozabadi, A.: "Reservoir Fluids Phase Behavior and Volumetric Prediction Using Equations of State," Distinguished Author Paper, *Journal of Petroleum Technology* (April 1988)397-406.

11. Firoozabadi, A.: "Author's Reply to Discussion of Reservoir-Fluid Phase Behavior and Volumetric Prediction with Equations of State," *Journal of Petroleum Technology* (Aug. 1988).

12. Firoozabadi, A. and Hauge, J.: "Capillary Pressure in Fractured Porous Media," *Journal of Petroleum Technology* (June 1990)784-791, also *AIME Transactions***,** 289(1990).

13. Firoozabadi, A. and Thomas, L.K.: "Sixth SPE Comparative Solution Project: Comparison of Dual-Porosity Reservoir Simulators," *Journal of Petroleum Technology* (June 1990)710-763.

14. Horie, T., Firoozabadi, A. and Ishimoto, K.: "Laboratory Studies of Capillary Interaction in Fractured/Matrix Systems," *SPE Reservoir Engineering Journal* (Aug. 1990)353-360.

15. Wong, T., Firoozabadi, A. and Aziz, K.: "The Relationship of the Volume Balance Method of Compositional Simulation to the Newton-Raphson Method," *SPE Reservoir Engineering Journal* (Aug. 1990)415-422, also *AIME Transactions*, 289 (1990).

16. Wong, T., Firoozabadi, A. and Aziz, K.: "The Relationship of the Volume Balance Method of Compositional Simulation to the Newton-Raphson Method," SPE 21462 (1990), supplement to SPE 18424, available from SPE, Richardson, TX.

17. Firoozabadi, A. and Aziz, K.: "Relative Permeability from Centrifuge Data," *Journal of Canadian Petroleum Technology* (Sept.-Oct. 1991)33-42.

18. Firoozabadi, A.: "Author's Reply to Discussion of Capillary Pressure in Fractured Porous Media," *Journal of Petroleum Technology* (February 1991)236-238.

19. Skuse, B., Firoozabadi, A. and Ramey, H.J., Jr.: "Computation and Interpretation of the Capillary Pressure from a Centrifuge," *SPE Formation Evaluation Journal* (March 1992)17-24, also *AIME Transactions*, 293(1992).

20. Bjorlykke, O.P., and Firoozabadi, A.: "Measurements and Computation of Retrograde Condensation and Near-Critical Phase Behavior," *SPE Reservoir Engineering Journal* (May 1992)271-277.

21. Firoozabadi, A.: "Author's Reply to Discussion of Computation and Interpretation of the Capillary Pressure from a Centrifuge," *SPE Formation Evaluation Journal* (Sept. 1992).

22. Firoozabadi, A., Ottesen, B. and Mikklesen, M.: "Measurements of Supersaturation and Critical Gas Saturation," *SPE Formation Evaluation Journal* (Dec. 1992)337-344.

23. Kashchiev, D., and Firoozabadi, A.: "Kinetics of the Initial Stage of Isothermal Gas Formation," *Journal of Chemical Physics* (March 15, 1993)98**(**6),4690-4699.

24. Firoozabadi, A., Arbabi, S. and Dindoruk, B.: "Near-Critical Phase Behavior of Mixtures Using Variable Interaction Coefficients," *Canadian Journal of Chemical Engineering* (February 1994)134-141.

25. Firoozabadi, A. and Ishimoto, K.: "Reinfiltration in Fractured Porous Media - Part 1- One Dimensional Model," *SPE Advanced Technology* (April 1994)35-44.

26. Firoozabadi, A., Ishimoto, K. and Dindoruk, B.: "Reinfiltration in Fractured Porous Media - Part 2 - Two Dimensional Model," *SPE Advanced Technology* (April 1994)45-51.

27. Firoozabadi, A., Ishimoto and Dindoruk, B.: "Reinfiltration in Fractured Porous Media - Part 2 - Two Dimensional Model," SPE 28516, supplement to SPE 21798, paper available from SPE, Richardson, TX.

28. Firoozabadi, A.: "Author's Reply to Discussion of Measurement of Supersaturation and Critical Gas Saturation," *SPE Formation Evaluation Journal* (June 1994)159-160.

29. Firoozabadi, A. and Markeset, T.: "Fracture-Liquid Transmissibility in Fractured Porous Media," *SPE Reservoir Engineering Journal* (Aug. 1994)201-207.

30. Dindoruk, B., and Firoozabadi, A.: "Liquid Film Flow in a Fracture between Two Porous Blocks," *Physics of Fluids* (Dec. 1994)3861-3869.

31. Lira-Galeana, C., Firoozabadi, A. and Prausnitz, J.M.: "Computation of Compositional Grading in Hydrocarbon Reservoirs," *Fluid Phase Equilibria* (Dec. 1994)143-158.

32. Tan, C.T., and Firoozabadi, A.: "Theoretical Analysis of Miscible Displacement in Fractured Porous Media - Part I - Theory," *Journal of Canadian Petroleum Technology* (February 1995)17-27.

33. Tan, C.T., and Firoozabadi, A.: "Theoretical Analysis of Miscible Displacement in Fractured Porous Media - Part II - Features," *Journal of Canadian Petroleum Technology* (February 1995)28-35.

34. Firoozabadi, A. and Markeset, T.: "Laboratory Studies in Fractured Porous Media, Part I - Reinfiltration for Gas-Liquid Systems," *In Situ* (February 1995)1-21.

35. Firoozabadi, A. and Markeset, T.: "Laboratory Studies in Fractured Porous Media, Part II- Capillary Crossflow," *In Situ* (February 1995)23-39.

36. Arbabi, S., and Firoozabadi, A.: "Phase Behavior Prediction of Reservoir Fluids in the Critical Region," *SPE Advanced Technology* (March 1995)139-145.

37. Shinta, A., and Firoozabadi, A.: "Equation of State Representation of Aqueous Mixtures Using an Association Model," *Canadian Journal of Chemical Engineering* (June 1995)367-379.

38. Firoozabadi, A., Thomas, L.K. and Todd, B.J.: "High Velocity Gas Flow in Porous Media," *SPE Reservoir Engineering Journal* (May 1995)149-152.

39. Dindoruk, B., and Firoozabadi, A.: "Computation of Gas-Liquid Drainage in Fractured Porous Media Recognizing Fracture Liquid Flow," *Journal of Canadian Petroleum Technology* (Dec. 1995)39-49.

40. Lira-Galeana, C., Firoozabadi, A. and Prausnitz, J.M.: "Thermodynamics of Wax Precipitation in Petroleum Mixtures," *AIChE Journal* (January 1996)239-248.

41. Correa, A., and Firoozabadi, A.: "Concept of Gravity Drainage in Layered Porous Media," *SPE Journal* (March 1996)101-111.

42. Victorov, A., and Firoozabadi, A.: "Thermodynamics of Asphaltene Deposition Using a Micellization Model," *AIChE Journal* (June 1996)1753-1764.

43. Firoozabadi, A. and Kashchiev, D.: "Evolution of Gas Phase in Solution Gas-Drive Process," *SPE Journal* (Sept. 1996)219-227.

44. Shinta A.A., and Firoozabadi, A.: "Predicting Phase Behavior of Water/Reservoir Crude Systems Using the Association Concept," *SPE Reservoir Engineering Journal* (May 1997)131-137.

45. Firoozabadi, A., and Prausnitz, J.M.: "Thermodynamics of Wax Precipitation in Petroleum Mixtures," Reply to the Letter to the Editor, *AIChE Journal* (May, 1997)

46. Dindoruk, B., and Firoozabadi, A.: "Crossflow in Fractured/Layered Media Incorporating Gravity, Viscous, and Phase Behavior Effects," *SPE Journal* (June 1997)120-135.

47. Firoozabadi, A.: "Author's Reply to the Discussion of Pressure and Volume Evolution in Solution Gas Drive Process," *SPE Journal* (June 1997)219-229.

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3. "Wettability Alteration to Intermediate Gas Wetting," 3M Corporation, St. Paul, MN, April 5.
4. "Numerical Simulation of Fractured Reservoirs Using the Discontinuous Galerkin – Mixed Methods and Proposal for Improved Recovery in Mexican Fractured Reservoirs," Pemex, Ciudad Del Carmen, Mexico, May 18.
5. "Numerical Modeling of Diffusion in Fractured Reservoirs," Invited Talk, SPE Forum on Naturally Fractured Reservoirs, Denver, CO, June 20.
6. "Thermodynamics of Hydrocarbon Reservoirs," Intensive Course, Palo Alto, Aug. 7-10. 14 participants.
7. "Thermodynamics of Hydrocarbon Reservoirs," Intensive Course, Chevron Technology Center, San Ramon, CA, Aug. 21-24, 14 participants.
8. "Gas Condensate Reservoirs," Intensive Course, Society of Petroleum Engineers, Houston, TX, 24 participants.
9. "Numerical Simulation of Multicomponent-Multiphase Flow in Fractured Media and Need for New Modeling," Petroleum Engineering Department, Texas A&M, College Station, TX, Aug. 29.
10. "Numerical Simulation in Fractured Media Incorporating the Concept of Crossflow Equilibrium" and "Well Deliverability Increase in Gas Condensate Reservoirs by Wettability Alteration," Total, Pau, France, Nov. 20.
11. "Numerical Simulation in Fractured Media Incorporating the Concept of Crossflow Equilibrium" and "Convection and Diffusion in Hydrocarbon Reservoirs," BP, Sunbury on Thames, UK, Nov. 21.
12. "Numerical Simulation in Fractured Media Incorporating the Concept of Crossflow Equilibrium" and "Well Deliverability Increase in Gas Condensate Reservoirs through Wettability Alteration," Maersk Oil and Gas, Copenhagen, Denmark, Nov. 22.
13. "Numerical Simulation of Gas and Water Injection in Fractures by Discontinuous Galerkin and Mixed Methods" and "Wettability Alteration to Intermediate Gas Wetting," ConocoPhillips, Houston, TX, Dec. 11.
14. "Diffusion in Multicomponent Mixtures and its Effect on Oil Recovery in Fractured Reservoirs," IMP, Mexico City, Dec. 12.

2007

1. "CO_2 Injection in Fractured Reservoirs," Occidental Oil and Gas, Elk Hills, CA, January 15.
2. "Thermodynamics and Mathematics of Species Transport in Permeable Media and Conduits," Yale University, Mechanical Engineering Department, New Haven, CT, March 30.
3. Invited External Examiner for PhD Thesis of Reza Darvish on "Physical Effects Controlling Mass Transfer in Matrix-Fracture System during CO_2 Injection Into Chalk Fractured Reservoirs," Department of Petroleum Engineering and Geophysics, Norwegian University of Science and Technology, Trondheim, Norway, April 16.
4. "Kinetics and Anti-Agglomeration in Gas Hydrates," Bergen University, Department of Chemistry, Bergen, Norway, April 17.
5. Invited External Examiner for PhD Thesis of Shan Pan on "Theoretical and Numerical Study of Thermodiffusion and Thermosolutal Convection," University of Toronto, Department of Chemical Engineering and Chemistry, August 10.
6. "Multicomponent Diffusion from Irreversible Thermodynamics," Rice University, Houston, TX, May 31.
7. "CO_2 Injection in Fractured Reservoirs," Mexican Petroleum Institute, Mexican Delegation Visit, Mexico City, Mexico, August 30.
8. "Hydrocarbon Energy Production and Environmental Stewardship," Yale University, September 12.
9. "CO_2 Injection in Fractured Reservoirs: Numerical Modeling and the Effect of Diffusion," ConocoPhillips, Bartlesville, OK, October 2.
10. "Numerical Modeling of Complex Reservoirs and the Use of High-Order Methods," Schlumberger Research, Cambridge, MA, October 5.

11. "Numerical Simulation of Fractured Petroleum Reservoirs for Improved Recovery," Occidental Oil and Gas, Houston, TX, October 11.
12. Invited External Examiner for PhD Thesis of Hassan Karimaie on "Aspects of Water and Gas Injection in Fractured Reservoirs," Norwegian University of Science and Technology, Department of Petroleum Engineering and Geophysics, Trondheim, Norway, December 17.
13. "Numerical Simulation of Complex Reservoir Problems for CO_2 Injection," Delft University of Technology, Department of Civil Engineering, Delft, Holland, December 18.

2008

1. "Diffusion Aspects of CO_2 Injection into Ekofisk Field" ConocoPhillips, Technology Research Center, Bartlesville, OK. March 3.
2. "Numerical Simulation of Gas and Water Injection in Complex Reservoirs Using Higher-order Methods," BP, Houston, May 20.
3. "Thermal diffusion in multicomponent mixtures: theoretical modeling and experiments," Invited Plenary Talk, 8th International Meeting on Thermodiffusion, Bonn, Germany, June 9-13.
4. "Study of CO_2 Injection in Brazilian Light and Heavy Oil Reservoirs," Petrobras, Rio de Janeiro, Brazil, June 26.
5. "CO_2 Injection in Hydrocarbon Reservoirs," Mechanical Engineering Department, Catholic University, Rio de Janeiro, Brazil, June 26.
6. "Interfacial composition at the Interface between two non-equilibrium phases," Chemical Engineering Department, Federal University of Rio de Janeiro, Rio de Janeiro, Brazil, June 27
7. "Modeling of non-equilibrium effects in CO_2-water and CO_2-hydrocarbons," Occidental Oil and Gas, Elk Hills, CA, July 7.
8. "Hydrocarbons Energy Production, and Environmental Stewardship," Shell Research Center, Rijsvijk, Holland, Nov. 24.
9. "Water-Hydrocarbons and Asphaltene Modeling Using Association and Physical Interactions" BP Research Center, Sunbury on Thames, UK, Nov. 27
10. "Unusual Issues of CO_2-water phase behavior and CO_2 oil-displacement in improved oil recovery and sequestration," Total, Paris, Nov. 28.

2009

1. "CO_2 Injection in Complex Subsurface Formations for IOR and Sequestration and Features in Thermodynamics and Fluid Mechanics," Keynote Talk, 4th International Conference on Energy and Applications, Abu Dhabi, Jan. 12-14.
2. "CO_2 Injection in Complex Subsurface Formations," Maersk Oil SA, Doha, Qatar, Jan. 17.
3. "CO_2 Injection in Complex Subsurface Formations for IOR and Sequestration and Features in Thermodynamics and Fluid Mechanics," Invited Talk, Chevron, San Ramon, CA, April 13.
4. "CO_2 Injection in Hydrocarbon Reservoirs: Phase Behavior, Diffusion, and Density-Driven Mixing," ConocoPhillips Company, Bartlesville, OK, April 23.
5. "CO_2 Injection in Hydrocarbon Reservoirs and the Effect of Density-Driven Mixing and Diffusion," Pemex, Ciudad del Carmen, Mexico, May 18.
6. Invited External Examiner for PhD Thesis of Rouhollah Farajzadeh on "Enhanced Transport Phenomena in CO_2 Sequestration and CO_2 EOR," Department of Civil Engineering, Delft University of Technology, Delft, Netherlands, June 2.
7. (a) "Asphaltene Precipitation in Petroleum Reservoirs," (b) "Alteration of Wettability by Surfactant Treatment," OMV Austria Exploration &Production GmbH, Vienna, Austria, June 4.

8. (a) "Theoretical Modeling of Diffusion Cell Experiments," (b) "Alteration of Wettability of Porous Media to Gas-Wetting," TOTAL SA, Paris, France, June 5.
9. "Effectiveness of Rhamnolipid Surfactant on Hydrate Anti-agglomeration," StatoilHydro ASA, Bergen, Norway, June 9.
10. "Effect of Diffusion and Density-Driven Mixing in CO_2 Injection," ConocoPhillips Company, Stavanger, Norway, June10.
11. "CO_2 Injection in Subsurface Formations and Features in Thermodynamics, Fluid mechanics and Numerical Modeling," Faculty of Engineering, Peking University, Peking, China, June 15.
12. "CO_2 Injection in Subsurface Formations and Features in Thermodynamics, Fluid mechanics and Numerical Modeling," Chemical Engineering Department, Tsinghua University, Peking, China, June 16.
13. "Equilibrium and Non-Equilibrium Thermodynamics of Hydrocarbon Reservoirs," Intensive Advance Course, Japan Exploration Co. Ltd. (JAPEX), Tokyo, Japan, June 17-19.
14. "Carbon Management Canada," Invited Expert Plan, Networks of Centers of Excellence – Canada, Ottawa, Canada, August 31 - September 2.
15. "Carbon Dioxide Injection in Complex Subsurface Formations and Features of the Process in Thermodynamics and Fluid Mechanics," Graduate Seminar, Department of Chemical Engineering, University of Waterloo, Waterloo, Ontario, Canada, Nov. 5.
16. "CO_2 Injection in Complex Subsurface Formations and Issues in Thermodynamics and Fluid Mechanics," Invited talk, AIChE Annual Meeting, Nashville, TN, Nov. 8-13.
17. "Framework for Compositional Modeling in Multiphase Flow: Fluid Flow by Finite Elements and Thermodynamic Stability Considerations," The Center for Subsurface Modeling, University of Texas, Austin, TX, Oct. 15.
18. "Theoretical and Numerical Modeling Aspects of CO_2 Injection in the Subsurface," Graduate Seminar, Department of Mechanical and Aerospace Engineering, Rutgers University, Piscataway, NJ, Dec. 9.
19. "Theoretical and Numerical Modeling of CO_2 Injection in the Subsurface," Graduate Seminar, King Abdullah University of Science and Technology (KAUST), Saudi Arabia, January 14.
20. "Framework for simulation of CO_2 and other gas injection schemes in the subsurface," Saudi Aramco (Aramco), Dhahran, Saudi Arabia, Jan. 18.
21. "Gas Condensate Reservoirs Recovery and Productivity," Kuwait Oil Company (KOC), Ahmadieh, Kuwait, Jan. 22.

2010

1. "Delayed Sedimentation in Asphaltenes by Size Reduction to nanoparticles using surfactants," "Precipitation Modeling," and other talks at Ecopetrol, Bogota, Columbia, Jan. 18.
2. "Numerical Simulation of Complex Hydrocarbon Reservoirs by Finite Element Methods," Invited Plenary Talk, 5th International Congress on Numerical Methods in Engineering, Guanajuato, Mexico, February 3-5.
3. Invited External Examiner for PhD Thesis of Benjamin Pierre "Pressure Waves in Pipelines and Impulse Pumping Physical Principles, Model Development and Numerical Simulation" Norwegian University of Science and Technology, Department of Petroleum Engineering and Geophysics, Trondheim, Norway, February 19.
4. "Compositional Modeling in Three-Phase Flow Using Higher Other Methods," ExxonMobil Production Research Company, Houston, TX, February 25
5. "CO_2 Sequestration in the Subsurface," Yale Climate and Energy Institute, Yale University, New Haven, April 19.
6. "Modeling of CO_2 Injection in the Tor Fractured Reservoir," Ekofisk Partners Meeting, Bartlesville, OK, February 21-23.
7. "Modeling of CO_2 Injection in Water-Flooded Fractured Reservoirs" Maersk Oil and Gas, Copenhagen Denmark, June 8.

8. "CO_2 Injection in the Ekofisk and Issues," ConocoPhillips Norway, Stavanger, Norway, June 9-11.
9. Invited External Examiner for PhD Thesis of Hamidreza Salimi "Physical Aspects of Upscaling of Fractured Reservoirs and Improved Oil Recovery Predictions" Department of Civil Engineering, Delft University of Technology, Delft, Netherlands, June 14.
10. "Thermodynamic Stability and Phase-Split Computations in Three-Phase," Schlumberger, Abington Technology Center, June 15.
11. "Physics and Modeling of CO_2 Injection in Fractured Media and Surprises," Gordon Research Conference ," July 12-16., Bates College, Lewiston, ME, July 12-16.
12. "CO_2 Injection Pilot in the Mexican Fractured Reservoirs," Pemex, Ciudad del Carmen, Mexico, Aug. 17.
13. Invited External Examiner for PhD Thesis of Radek Fucik "Advanced Numerical Methods for Modeling Two-Phase Flow in Heterogeneous Porous Media," Faculty of Nuclear Sciences and Physical Engineering, Czech Technical University in Prague, Prague, Nov. 12.

2011

1. "Higher-order Numerical Modeling of Multiphase Flow in Unfractured and in Fractured Media," Institute of Hydraulic Engineering University of Stuttgart, Stuttgart, Germany, Jan. 31.
2. "Higher-order Modeling of CO_2 Subsurface Sequestration Coupled with Cross Association of CO_2 and H_2O Molecules," Department of Earth Sciences, Imperial College London, February 1.
3. "CO_2 Injection in the Subsurface and Aspects from Thermodynamics, Fluid Dynamics and Mathematical Modeling," Department of Chemical Engineering, Princeton University, Princeton, NJ, February 3.
4. "Thermodynamic Stability Testing and Phase-split Calculation in Two- and Three-Phase," Saudi Aramco, Dhahran, March 14.
5. "Water, CO_2, and N_2 Injection in Near-critical Fractured Reservoirs," Joint Meeting of Kuwait Oil Company, Schlumberger and Shell, Kuwait City, Kuwait, March 16.
6. a) "Nano-particle Stabilization of Asphaltenes and Hydrates," b) "Two- and Three-phase Compositional Modeling of CO_2 Injection with CPA Equation of State," ADCO, Abu Dhabi, March 17.
7. "Carbon Dioxide Injection in the Subsurface and Considerations in Thermodynamics, Fluid Mechanics, and Numerical Modeling," Clarkson University, Potsdam, New York, March 29.
8. "Two- and Three-phase Compositional Modeling of CO_2 Injection with CPA Equations of State," ConocoPhillips, Houston, TX, April 6.
9. "Species Distribution and Recovery Performance form Fluid Injection in a Giant Field," Petrobras, Rio de Janeiro, April 15.
10. "CO_2 Subsurface Injection and Related Issues in Thermodynamics, Fluid Mechanics, and Numerical Modeling," School of Engineering and Applied Sciences, Harvard University, May 3.
11. "Asphaltene Stabilization in Petroleum Fluids and Precipitation Modeling," BP, Houston, TX, November 4.
12. "Nano-particles in Hydrocarbon Energy Production," University of California-Riverside, Environmental Sciences Department, Riverside, CA, November 21.
13. "Nano-particles in Hydrocarbon Energy Production," Illinois Institute of Technology, Department of Chemical and Biological Engineering, Chicago, IL, November 30.
14. "Carbon Dioxide Injection in the Subsurface and Considerations in Thermodynamics, Fluid Mechanics, and Numerical Modeling," University of Oklahoma, Department of Petroleum Engineering, Norman, OK, December 2.
15. "Nano-particles in hydrocarbon energy production", "CO_2 injection in heterogeneous and fractured media", Total Research Center Pau, France, December 5.
16. "CO_2 Injection in Complex Reservoirs for Improved Oil Recovery," AGR, Oslo, Norway, December 6.

2012

1. "Lectures in Thermodynamics and in Multiphase Flow in Fractured Permeable Media," Mexican Petroleum Institute, Mexico City, Mexico, January 12-13 (about 25 attendee from IMP scientists).
2. "Nano-particles in Hydrocarbon Energy Production," King Abdullah University of Science and Technology (KAUST), Thuwal, Saudi Arabia, March 3.
3. "Electrostatic Stabilization of Asphaltene Colloidal Particles through Effective Dissolution by Surfactants in Petroleum Fluids," ADCO, Abu Dhabi, March 5.
4. "CO_2 Effectiveness in Improved Oil Recovery in Fractured media," ConocoPhillips, Houston, April 19.
5. "Carbon Dioxide Injection in the Subsurface and Considerations in Physics and Numerical Modeling," Opening talk, Acid Gas International Symposium, AGIS2012, Banff, Canada, May 31- June 1.
6. "Framework to Study Complexities from the Combined Effects of Thermal, Pressure, and Fickian Diffusions in Multi-components," Keynote lecture, Tenth International Thermodiffusion Conference (IMT-10), Brussels, Belgium, June 4-8.
7. "Carbon Dioxide Injection in the Subsurface and Considerations in Physics and Numerical Modeling," Opening talk, Third International Acid Gas Injection Symposium (AGIS 2012), Banff, Canada, May 29-June 1.
8. "CO_2 and WAG Injection in a Complex Fractured Reservoir," Kuwait Oil Company, Kuwait, June 11.
9. "Asphaltene Stabilization and Dissolution in Crude Oil Systems," Kuwait Oil Company, Kuwait, June 11.
10. "Accurate and Efficient Reservoir Simulation Modeling by Higher-order Methods" Schlumberger, Houston, September 24.
11. "Phase Behavior and Adsoprtion in Nano-pores," BHP, Houston, TX, September 24.
12. (a) "Phase Behavior and Adsorption in Shale", and (b) "Nano-particles of Asphaltenes and Hydrates in Flow Assurance", Chevron, Houston, September 25.
13. "Phase Behavior and Adsorption in Nano-pores from Density Functional Theory," Shell, Houston, TX, September 26.
14. "High-order Numerical Modeling of CO_2 Injection in the Subsurface," Landmark Graphics - Halliburton, Houston, September 26.
15. "Phase Behavior and Adsorption in Shale," Chesapeake Energy Corporation, Oklahoma City, OK, September 27.
16. "CO_2 Injection in the Subsurface and High-order Numerical Simulation," Distinguished Speaker Talk, University of Calgary, Department of Chemical and Petroleum Engineering, Calgary, Canada, Dec. 6
17. "Nano-particles in Hydrocarbon Energy Production", Distinguished Speaker Talk, University of Calgary, Department of Chemical and Petroleum Engineering, Calgary, Canada, December 7.
18. "CO_2 Injection is Heavy and Super-heavy Oil Fractured Reservoirs," Pemex, Cd. Del Carmen, Mexico, December 12.

2013

1. "Asphaltene Colloidal Stabilization and Dissolution from Deposition in Crudes," Kuwait Oil Company, Kuwait, March 11.
2. "Hydrate Anti-agglomeration with an Efficient New Molecule," RasGas, Doha, Qatar, March 12.
3. (a) "Nanoparticles and Efficient Molecular Dissolution in Flow Assurance and Heavy Oil Viscosity Reduction," and (b) "Higher-Order Simulation and Fickian Diffusion Modeling," ExxonMobil Production Research, Houston, TX, March 18.
4. "Phase Behavior in Shale Permeable Media," ConocoPhillips, Houston, TX, March 19.
5. "Phase Behavior in Shale Permeable Media," Anadarko, Houston, TX, March 19.

6. "Well Deliverability Improvement in Gas Condensate Reservoirs," Pemex, Ciudad del Carmen, Mexico, April 11.
7. "Higher-Order Numerical Modeling of CO2 Injection in Complex Processes and Complex Subsurface Formations," Invited task, 7th MIT Conference on Computational Fluid and Solid Mechanics, Cambridge, MA, June 12-14.
8. "Phase Behavior in Shale Gas and Shale Light Oil Reservoirs," Lawrence Livermore National Laboratory, Livermore, CA, August 23.
9. "Thermodynamics of Oil Reservoirs," Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil, September 4-5 (one and a half day lectures for 45 faculty members and PhD students from various Brazilian universities and Petrobras Research Center).
10. "Molecular Dancing, Molecular Structure, and Nanoparticle Hydrocarbon Energy Production," Department of Chemical and Biomolecular Engineering, University of Maryland, College Park, MD, October 8.
11. "When Water and Oil Mix; Consequences for Water Flooding," SPE Long Beach WaterFlood Workshop, Long Beach, CA, October 23.
12. "Ion Specificity and Structure in Micelles and Emulsions," Chevron, Houston, TX, November 19.
13. (a) "Molecular Structure and Nanoparticles in Relation to Gas Hydrates and Asphaltenes," and (b) "CO2 Injection in the Subsurface and Complexities and the need for Higher-Order Numerical Modeling," Statoil Research, Development and Innovation Centre, Trondheim, Norway, September 19.
14. (a) "Molecular Structure and Nanoparticles in Relation to Gas Hydrates and Asphaltenes," and (b) "CO2 Injection in the Subsurface and Complexities and the need for Higher-Order Numerical Modeling," Total SA, Pau, France, September 20.
15. (a) "Molecular Structure and Nanoparticles in Relation to Gas Hydrates and Asphaltenes," and (b) "CO2 Injection in the Subsurface and Complexities and the need for Higher-Order Numerical Modeling," INPEX, Tokyo, Japan, November 5.
16. (a) "Molecular Structure and Nanoparticles in Relation to Gas Hydrates and Asphaltenes," and (b) "CO2 Injection in the Subsurface and Complexities and the need for Higher-Order Numerical Modeling," Technology and Research Center, Japan Oil, Gas and Metals National Corporation (JOGMEC), Tokyo, Japan, November 6.
17. "Phase Behavior in Shale Permeable Media," Chesapeake Energy, Oklahoma City, OK, November 20.
18. "Modeling of Three-Phase Complex Flow in Complex 3D Unstructured Grids with Higher-Order Finite Element," Invited talk, 2nd International Conference on Engineering and Computational Mathematics (ECM2013), Hong Kong Polytechnic University, Hong Kong, China, December 16-18.

2014

1. "Higher-Order Numerical Modeling of Complex Processes in Complex Subsurface Fractures," Baker Hughes Research Center, Palo, CA, January 9.
2. "Molecular Dancing, Molecular Structures, and Nanoparticles in Hydrocarbon Energy Production," University of Maine, on behalf of Mediaul Energy, Bangor, ME February 8.
3. "Shale Gas and Shale Light Oil Reservoirs: Phase Behavior and Flow Modeling," Mexican Petroleum Institute (IMP), Mexico City, Mexico, September 2.
4. "Molecular Assembly and Structures in Hydrates and Asphaltenes in Relation to Flow Assurance," Plenary Invited Talk, PetroPhase 2014, Galveston, TX, June 8 – 12.
5. "Structures in Petroleum Fluid/Rock Systems in Relation to Flow Assurance and Oil Recovery," Department of Earth Resource Engineering, Imperial College, London, U.K., October 30.
6. "Advanced Reservoir Simulation in Complex Subsurface Conditions Based on Higher-Order Methods," Schlumberger, Abington, U.K., October 31.
7. "Asphaltene Stabilization and Molecular Dissolution in Petroleum Fluids," Kuwait Oil Company (KOC), Kuwait City, Kuwait, November 2.

8. "CO_2 Injection in the Subsurface for Improved Recovery and Sequestration," Opening Talk of the luncheon for ADIPEC, Abu Dhabi, November 11.
9. "Molecular Structures in Petroleum Fluids," Upstream Technology Symposion, King Abdullah University of Science and Technology (KAUST), Thuwal, Saudi Arabia, November 12 – 13.
10. "Molecular Thermodynamics of Self-assembly in Micelles and in Micro-emulsions," Corporate Strategic Research, ExxonMobil Research and Energy, Annandale, NJ, December 1.
11. "Thermodynamics of Shale Reservoirs," ConocoPhillips, Houston, TX, December 3.

PhD Students
(name, year of graduation, PhD Thesis, current affiliation)

Yale University

1. Jane W. Mutoru, (2012); Theoretical Investigations of Self and Fickian Diffusion Coefficients in Thermodynamically Stable Systems and in the Critical Region; ConocoPhillips
2. Livia A. Moreira, (2012); Molecular thermodynamic modeling of micelles and microemulsions; Max Plank Institute
3. John Dalton York, (2008); Experimental and Theoretical Developments in Hydrate Anti-Agglomeration; Riverdale High School, Murfreesboro, TN
4. Alana-Leahy-Dios, (2008); Experimental and Theoretical Investigation of Fickian and Thermal Diffusion Coefficients in Hydrocarbon Mixtures; ExxonMobil Production Research
5. Kjetil Haugen, (2007); Theoretical Analysis of Separation of Multicomponent Liquid Mixtures in Thermogravitational Columns and Thermal Diffusion Cells; ExxonMobil Production Research

Imperial College - London

1. Hadi Nasrabadi (2006); Compositional Variation in Two-Phase Hydrocarbon Reservoirs from Diffusion and Natural Convection; Texas A&M University
2. Mashhad Fahes (2006); Wettability Alteration from Liquid-Wetting to Intermediate Gas-Wetting at High Temperatures; University of Oklahoma
3. Reza Banki (2006); Numerical Modeling of Wax Deposition in Pipelines from Irreversible Thermodynamics; Chevron
4. Lamia Goual (2003); Measurement and Modeling of Asphaltene Precipitation from Petroleum Fluids and the Effect of Resins and Amphiphiles; University of Wyoming

Past Researchers, Postdoctoral Fellows, and Visiting Scientists
(name, year of joining RERI, current affiliation)

1. Mark Anklam, PhD (2003); California Baptist University
2. Sepehr Arbabi, PhD; Shell Oil
3. Andrew Aronson, MS
4. Eric Chang, PhD (1996); Synopsys
5. Michael Bestehorn (2011); Brandenburg Technical University Cottbus
6. Antonio Corrêa, PhD; Petrobras
7. Birol Dindoruk, PhD; Shell International E&P, University of Houston
8. Rogério Espósito, PhD (2009); Petrobras
9. Kassem Ghorayeb, PhD (1997); Schlumberger

10. Hussein Hoteit, PhD (2003); Chevron
11. Koichiro Ishimoto, MS; JX Nippon Oil & Gas Exploration
12. Mohammad Karimi-Fard, PhD (1999); Stanford University
13. Dimo Kashchiev, PhD; Institute of Physical Chemistry, Bulgarian Academy of Sciences
14. Kewen Li, PhD (1997); Stanford University, Peking University
15. Zhidong Li, PhD (2007); ExxonMobil
16. Carlos Lira-Galeana, PhD; Instituto Mexicano del Petroleo
17. Tore Markeset, PhD; University of Stavanger
18. Jiří Mikyška, PhD (2009); Czech Technical University
19. Jorge Monteagudo, PhD (2004); ConocoPhillips
20. Joachim Moortgat, PhD (2008); Ohio State University
21. Mohammad Moravvej, MS (2008); University of Chicago
22. Hussein Mustafa, PhD (2007); Schlumberger
23. Vladimir Nichita, PhD (1999); Université de Pau
24. Myeong Noh, PhD (2004); Chevron
25. Huanquan Pan, PhD (1995); Stanford University
26. Mehran Pooladi-Darvish, PhD (1995); University of Calgary
27. Nima Rezaei, PhD (2011); Shiraz University
28. Mike Riley, PhD (1996);
29. Fernando Rodriguez, PhD; Pemex
30. Erik Santiso, PhD; North Carolina State University
31. Ebrahim Shahraeeni, PhD (2011); Forschungszentrum Jülich
32. Keshawa Shukla, PhD; McDermott Subsea Engineering
33. Lixin Sun, PhD (2005); Aspen Technology
34. Shuyu Sun, PhD (2009); King Abdullah University of Science and Technology
35. C.T. (James) Tan, PhD; Saudi Aramco
36. Ivan Terez, PhD (1999); ENI
37. Alexey Victorov, PhD; St. Petersburg State University
38. Stan Wu, PhD (2007); Chevron