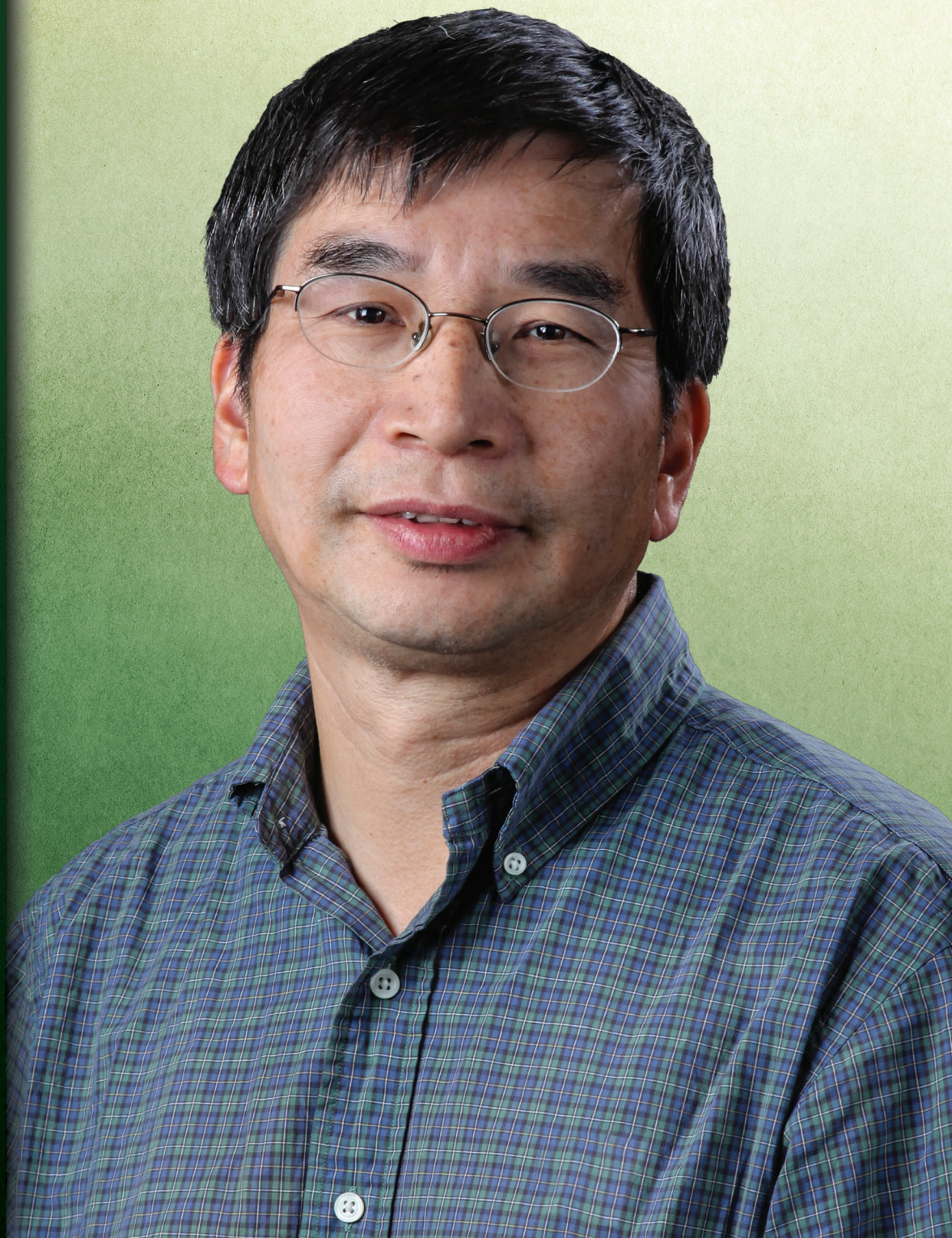
Sandia National Laboratories

AAEOY 2014 nomination

SAND2013-8971P

王益峰

Yifeng Wang



Nomination Form

2014 AAEOY Award Nomination Form

Please complete one Nomination Form per nominee.

Nominee's name:
Yifeng Wang Title/Position: Distinguished Member Technical Staff

Award Category:

☐ *Asian American Executive of the Year*

☒ *Asian American Engineer of the Year*

☐ *Asian American Most Promising Engineer of the Year*

Citation of Accomplishment (See Instruction and example on the next page):
Pioneering contributions to nanogeochemistry, nonlinear geochemistry and environmental material development and sustained contributions to backend nuclear fuel cycle research.

Company name:
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1515 Eubank, SE, Albuquerque, NM 87123

Contact phone no. 505-844-8271 FAX no. 505-844-2348 E-mail ywang@sandia.gov

Nominee's mailing address: P.O. Box 5800, Sandia National Labs, Albuquerque, NM87185-0779

Nominator's name:
Dr. Paul J. Hommert Title/Position: President and Laboratories Director

Company name:
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Nominator's mailing address: P.O. Box 5800, Sandia National Labs, Albuquerque, NM87185-0101

The Nominator certifies that, to the best of his (her) knowledge, all information about the Nominee included in the Nomination Package (see instruction on the next page) is accurate and verifiable. Please include a scanned signed copy of this form in the Nomination Package to be submitted via e-mail to **nomination2014@aaeoy.org** by **October 31, 2013.**

Nominator's signature _____, Date _____

(Continue on next page)

Biographical Profile

Dr. Yifeng Wang grew up in a small village in Zhejiang Province, China. He is a graduate of Zhejiang University (B.S. in Geology), Nanjing University (MS in Geochemistry), and Indiana University (Ph.D. in Geochemistry). He and his wife have one child. Yifeng came to the United States in March 1988.

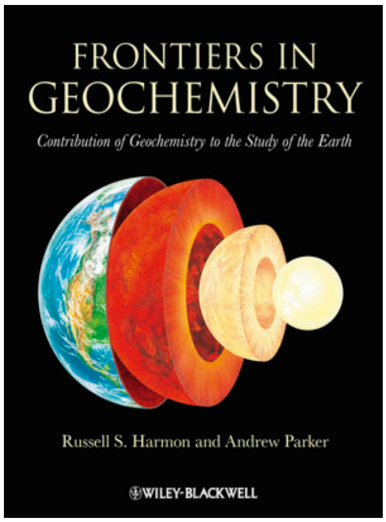
Yifeng is a Distinguished Member of Technical Staff at Sandia National Laboratories (Sandia) in Research & Development, Science and Engineering, Geosciences. He is a technical lead or principal investigator for projects related to nuclear waste disposal, shale gas research, carbon sequestration and storage, and environmental nanomaterial development.

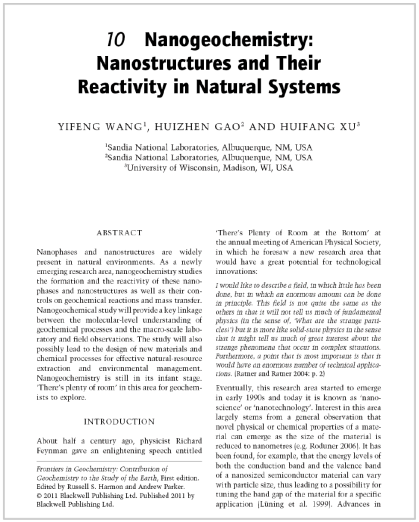
Yifeng's career began at Georgia Institute of Technology in 1993, where he spent 1.5 years as a postdoctoral fellow, working on biogeochemistry of aquatic sediments. He developed the first multicomponent, coupled reactive transport model for simulating biogeochemical processes in marine sediments.

In 1995, he joined Sandia as a Senior Member of Technical Staff and began work on geologic disposal of radioactive waste. As principal investigator of the near-field chemistry and gas generation programs for the Department of Energy (DOE) Waste Isolation Pilot Plant (WIPP), he developed an innovative method of using magnesium oxide (MgO) to control near-field chemistry and absorb carbon dioxide. He also performed pioneering work on the potential application of nanostructured materials in nuclear waste management.

As a Principal Member of Technical Staff from 2000 to 2010, he started working on the Yucca Mountain (YM) Repository Program. He was a member of the Independent Validation Review Team for the YM project, and he served on the DOE In-Depth Review Team for the YM Engineered Barrier System. Yifeng was first to demonstrate the effect of nanopore confinement on mineral-water interface chemistry.

In 2011, Yifeng was nominated and appointed to Distinguished Member of Technical Staff. Currently, he is the technical lead for the DOE Used Fuel Disposition (UFD) Natural System Evaluation Work Package and the principal investigator of a Laboratory Directed Research & Development project on shale gas disposition and release. He coordinates dozens of technical staff across eight national laboratories and universities for the UFD project. He has published over 80 peer-reviewed publications and has six issued or pending U.S. patents. He is the editor-in-chief of American Institute of Mathematical Science's *Environmental Science*.





10 Nanogeochemistry: Nanostructures and Their Reactivity in Natural Systems

YIFENG WANG[1], HUIZHEN GAO[2] AND HUIFANG XU[3]

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[3]University of Wisconsin, Madison, WI, USA

ABSTRACT

Nanophases and nanostructures are widely present in natural environments. As a newly emerging research area, nanogeochemistry studies the formation and the reactivity of these nanophases and nanostructures as well as their controls on geochemical reactions and mass transfer. Nanogeochemical study will provide a key linkage between the molecular-level understanding of geochemical processes and the macro-scale laboratory and field observations. The study will also possibly lead to the design of new materials and chemical processes for effective natural resource extraction and environmental management. Nanogeochemistry is still in its infant stage. 'There's plenty of room' in this area for geochemists to explore.

INTRODUCTION

About half a century ago, physicist Richard Feynman gave an enlightening speech entitled 'There's Plenty of Room at the Bottom' at the annual meeting of American Physical Society, in which he foresaw a new research area that would have a great potential for technological innovations:

I would like to describe a field, in which little has been done, but in which an enormous amount can be done in principle. This field is not quite the same as the others in that it will not tell us much of fundamental physics (in the sense of, 'What are the strange particles?') but it is more like solid-state physics in the sense that it might tell us much of great interest about the strange phenomena that occur in complex situations. Furthermore, a point that is most important is that it would have an enormous number of technical applications. (Ratner and Ratner 2004: p. 2)

Eventually, this research area started to emerge in early 1990s and today it is known as 'nanoscience' or 'nanotechnology'. Interest in this area largely stems from a general observation that novel physical or chemical properties of a material can emerge as the size of the material is reduced to nanometres (e.g. Rodmer 2006). It has been found, for example, that the energy levels of both the conduction band and the valence band of a nanosized semiconductor material can vary with particle size, thus leading to a possibility for tuning the band gap of the material for a specific application (Lüning et al. 1999). Advances in

Frontiers in Geochemistry: Contribution of Geochemistry to the Study of the Earth, First edition. Edited by Russell S. Harmon and Andrew Parker.
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Cover of the book containing a chapter on nanogeochemistry contributed by Yifeng and his colleagues. Yifeng pioneered this new research field and gave it its name.

Qualification and Requirements

Addresses

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Yifeng and Jianjun with Yifeng's parents and brothers in China in 1987

Personal

Born October 1962 in Zhejiang Province, China
Married, one child
U.S citizen
Wife: Jianjun Lin, Software Engineer
(Sandia National Laboratories)
Son: Michael Wang, Senior at University of Chicago
Father: Shouzhang Wang, living in China
Mother: Yueqin Yu, living in China
Hobbies: Fishing, hiking, and playing badminton

Education

Indiana University (1988 to 1993)
Ph.D. in Geochemistry (minor in Geophysics) under Professor Enrique Merino. "Genesis of Repetitive and Non-Repetitive Textures in Diagenetic, Weathering, and Igneous Processes: Feedbacks, Boundary Conditions, Self-Organization, and Reaction-Transport Models," (Ph.D. dissertation., Indiana University, 1993).

Nanjing University (1982 to 1985)
MS in Geochemistry (Economic Geology) under Professor Zhujun Feng. "A Mathematical Model for Computer Simulations of Water-rock Reactions," (MS thesis, Nanjing University, 1985).

Zhejiang University (1978 to 1982)
B.S. in Geology.

Yifeng, his son (Michael Wang), and his wife (Jianjun Lin) in Oslo, Norway in the summer of 2008

Professional Achievements

Current Employment

2011 to Present: Distinguished Member of Technical Staff, Sandia National Laboratories. Yifeng is involved in diverse research activities, including nuclear waste disposal, the development of nanostructured materials for environmental applications, shale gas research, and complexity theory of Earth systems. He provides scientific leadership and vision for the Department of Energy (DOE) Used Fuel Disposition Natural System Evaluation project across eight DOE national laboratories and universities, with total budget up to $3.2M per year.

Previous Employment

2000 to 2010: Principal Member of Technical Staff, Sandia National Laboratories. Yifeng was a member of the Independent Validation Review Team for the Yucca Mountain (YM) Project and a member of DOE's In-Depth Review Team for YM Engineered Barrier System. He worked on a number of key projects related to nuclear disposal. He was first to demonstrate the effect of nanopore confinement on mineral-water interface chemistry and coined the term "nanogeochemistry," which was later accepted as a new research area by the

geochemical community. Yifeng was also an adjunct associate professor at the University of New Mexico.

1995 to 1999: Senior Member of Technical Staff, Sandia National Laboratories. Yifeng was the principal investigator of the near-field chemistry and gas generation programs for the DOE Waste Isolation Pilot Plant (WIPP)—the first operational deep geologic repository for transuranic nuclear waste disposal in the world. He developed an innovative idea of using magnesium oxide (MgO) to control near-field chemistry and absorb carbon dioxide. He designed theoretical as well as experimental work to demonstrate the effectiveness of the concept. Yifeng's demonstration of this innovation convinced technical communities (including the highly prestigious Academy of Sciences review team) of its efficacy, which made a critical contribution to the Environmental Protection Agency's (EPA) ultimate approval of WIPP. The MgO backfills have been in use since the opening of WIPP and have become an important part of the WIPP operation.

1993 to 1994: As a postdoctoral research fellow at Georgia Institute of Technology, Yifeng worked with Professor Philippe van Cappellen on biogeochemistry of aquatic sediments and developed the first multicomponent coupled reactive transport model for biogeochemical processes in marine sediments. He published a number of high impact research articles on this topic, which have been widely cited by the scientific community and textbooks.

Prominent Engineering or Engineering Related Projects

In his more than 18 years at Sandia, Yifeng has demonstrated his technical leadership in solving complex, mission-critical engineering issues. Some of the highlights are summarized below.

Waste Isolation Pilot Plant Project: WIPP is the first licensed deep geologic nuclear waste repository in the world. Yifeng was a key contributor to WIPP development and its license application. He was the principal investigator for both the disposal room chemistry study and the gas generation programs. Based on his thermodynamic calculations, Yifeng conceived and demonstrated the concept of using magnesium oxide (MgO) to both sequester microbially generated carbon dioxide and control WIPP disposal room chemistry. This new concept greatly simplified the long-term WIPP performance assessment (PA) calculations. MgO backfill was eventually accepted by EPA regulators as the only

Magnesium oxide (MgO) is being placed on top of a stack of transuranic waste containers at the Waste Isolation Pilot Plant (WIPP). Yifeng conceived and developed the concept of using MgO to control repository chemistry. MgO is a key component of the WIPP repository.

Source: http://www.epa.gov/radiation/docs/wipp/doe_mgo_factsheet_42407.pdf).

engineered barrier in the WIPP repository design. The former WIPP PA department manager, Dr. Rip Anderson, commented, "…these two brilliant ideas, and his demonstrated proofs, saved the WIPP project millions of dollars and allowed the project to keep on schedule. WIPP was licensed and began receiving wastes in 1999." At the same time, Yifeng effectively coordinated the multiple-national lab WIPP gas generation program with an annual budget over $1M. He was responsible for providing overall technical direction of the program and ensuring each lab provided the needed experimental data for WIPP PA calculations. Yifeng synthesized all gas generation data and developed a so-called average stoichiometry model, thus providing a key linkage between waste degradation and near-field multi-phase flows for WIPP PA calculations. He was also a critical participant in writing the WIPP Compliance Certification Application (CCA). In addition, he coauthored the CCA appendix of Waste Characterization Limits. His contributions were highly valued by WIPP project management.

National Transuranic Program: After the WIPP CCA, Yifeng helped the National Transuranic (TRU) Program (NTP) (while still serving as the principal investigator of the WIPP gas generation effort) to develop the national strategy for TRU waste transportation and characterization. Yifeng played a key role in formulating the roadmap for NTP technology development. He coauthored the "Task Force Finding and Recommendation" document, which was highly valued by the DOE-Carlsbad Office. He advocated for the potential applications of Sandia-developed microsensor technology, nondestructive detection methods, and hydrogen getter materials in transuranic characterization and management. DOE eventually funded Sandia for a study of using hydrogen getter materials to mitigate the problem of waste container overpressure due to hydrogen gas accumulation. Because of his broad technical knowledge, Yifeng was identified by management as a key person for integrating the WIPP repository program and the National TRU Program at Sandia.

Yucca Mountain Project: The Yucca Mountain (YM) repository was proposed by DOE for disposal of high level nuclear wastes. Because of his extensive expertise in repository chemistry, Yifeng was selected, in 2003, by the DOE Office of Civilian Radioactive Waste Management (OCRWM) to join the DOE In-Depth Review Team for YM Engineered Barrier Systems (EBS). This team of technical experts reviewed the scientific basis of the YM EBS design and modeling, a key component for the YM license application. Later, Yifeng was asked to join the Independent Validation Technical Review Team (IVRT) to review the overall YM Total System Performance Assessment (TSPA) model. "His superb expertise in repository chemistry allowed him to immediately find the weak areas and suggest research solutions." (Dr. Rip Anderson). In particular, Yifeng found a fundamental flaw in the YM microbial activity evaluation, and he was asked to lead the subsequent effort to address the flaw. Yifeng's new approach changed the direction of the research. He was the lead author of the analysis/model report for YM microbial activity evaluation and the technical lead of the near-field chemistry for the YM performance margin analysis, which was a key component for

"…these two brilliant ideas, and his demonstrated proofs, saved the WIPP project millions of dollars and allowed the project to keep on schedule. WIPP was licensed and began receiving wastes in 1999."

- WIPP PA department manager, Dr. Rip Anderson

YM TSPA validation. Yifeng led a multiple-lab team under tight time constraints to complete the performance margin analysis.

OCRWM Science & Technology Project on Getter Material Development: The OCRWM S&T program was to provide advanced science and technology to enhance the general understanding of a nuclear waste repository system and to reduce the cost of repository design. Yifeng led a multi-lab/university, multiple million dollar project to develop nanostructured materials to immobilize radionuclides in repository environments. Yifeng was responsible for identifying tasks, prioritizing assignments, supervising experimental work and synthesizing the results. Yifeng's work on technetium sorption on layered double hydroxides and activated carbon (*Journal of Colloid and Interface Science*, [*2006*], 301, 19-26; [*2007*], 305, 209-217) has been well received in the scientific community. In this work, he established a functional relationship between radionuclide sorption and material structures. This work points to a new direction for engineering high performance adsorbent materials for nuclear waste isolation and environmental remediation.

Waste Separation/Waste Form Projects: Yifeng secured and actively engaged several DOE-nuclear energy waste separation/waste form projects. He was the principal investigator of a highly visible project entitled "Use of nanocomposite materials (SNL-NCP) to entrap and immobilize highly volatile/soluble radionuclides." Yifeng's project was selected for funding out of roughly 300 proposals nationally. Yifeng led a successful team from multiple internal Sandia organizations and developed a novel set of inorganic nanoporous materials for the separation and immobilization of gaseous radionuclides including iodine-129. One U.S. patent was filed. This work could strongly influence the off-gas treatment of a used fuel reprocessing plant and potentially result in enormous savings since the off-gas treatment is estimated to account for up to 15 percent of total fuel reprocessing cost (billions of dollars).

Yifeng was also the Sandia principal investigator for the generic disposal system environment modeling for the Global Nuclear Energy Program (GNEP). This project required extensive international laboratory coordination. Yifeng provided overall technical guidance with clearly defined objectives, developed detailed project plans, and communicated the guidance/plans to his team members, and coordinated the work across multi-labs with technical judgment. Yifeng and his team accomplished all the milestones within budget and on-time, meeting the customers' expectations.

Yifeng actively participated in formulating the national waste form development R&D roadmap for GNEP (later to become the Advanced Fuel Cycle Initiative, then Fuel Cycle R&D [FCR&D], all DOE-NE funded programs). His proposed adaptive waste form concept could potentially have a significant impact on future waste form studies. In Fiscal Year (FY) 2010, Yifeng was asked to serve as a member of the FCR&D Off-Gas Sigma Team, a national multi-disciplinary team from labs, academia, and industry to formulate a future R&D roadmap for off-gas treatment of used fuel reprocessing.

"His superb expertise in repository chemistry allowed him to immediately find the weak areas and suggest research solutions."
- Dr. Rip Anderson

Used Fuel Disposition Projects: The Used Fuel Disposition (UFD) campaign is a multi-million dollar, multiple lab DOE-NE funded program with an objective to develop a comprehensive used nuclear fuel disposition strategy for the United States. Yifeng is one of the technical staff participating in the campaign from its inception. In FY 2010, he was the project manager and technical lead for two key work packages: (1) Generic Disposal System Environment (GDSE) modeling and (2) Natural Systems Evaluation and Tool development. He was responsible for developing detailed project plans, communicating the overall technical guidance to multiple national labs and coordinating all related activities to ensure the completion of the planned milestones. At the FY2010 year-end review, the progress made for the work by Yifeng and his team was well received by the DOE-NE customers. Yifeng oversaw a total budget of approximately $8M from FY2011 to FY2013.

Nuclear Energy Advanced Modeling & Simulation Project: This DOE-NE funded Nuclear Energy Advanced Modeling & Simulation (NEAMS) program was intended to develop a set of fully verified and validated integrated performance and safety codes (IPSC) for advanced fuel cycle development. Sandia was responsible for the waste disposal IPSC development. Yifeng was the team lead for the performance assessment (PA) code development. The objective of this work was to develop a next generation PA system for future repository site selection and evaluation. His team included more than five technical staff. As the team lead, Yifeng was responsible for identifying key technical issues, developing the work plan, supervising the implementation of the plan, and documenting the results. Yifeng was instrumental in setting up the software architecture and developing use cases and challenge problems for the entire project.

Laboratory Directed Research & Development Projects: While making strong contributions to important Sandia efforts (e.g. WIPP, Yucca Mountain) Yifeng has built a large research program focused on developing cutting edge materials science and computational tools to address national problems. He has been the principal investigator for six Laboratory-Directed Research & Development (LDRD) projects and the co-principal investigator for another three. The total budget that

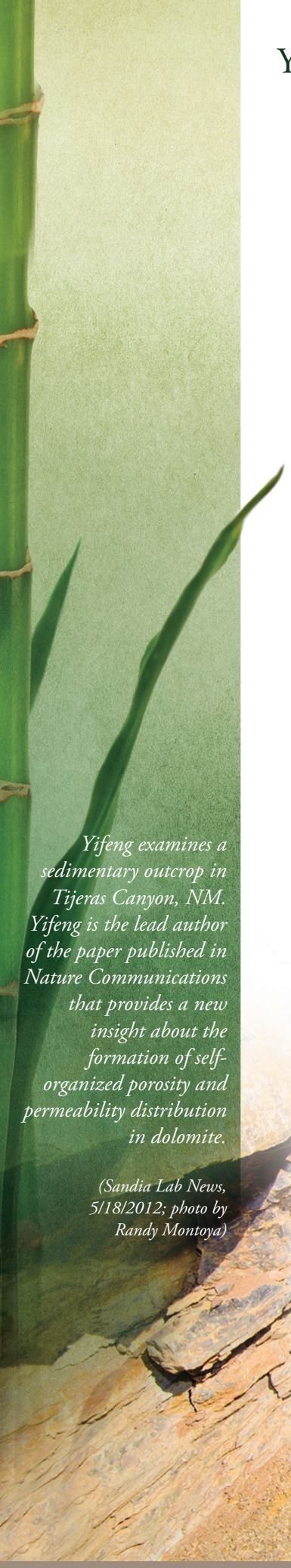
Yifeng holds a piece of banded iron formation during a visit to the Albuquerque Aquarium. Yifeng and his colleagues have proposed an explanation for the precipitation of banded iron formation in the planet's ocean billions of years ago. The work is published in Nature Geoscience.

(Sandia Lab News, 11/6/2009, photo by Randy Montoya)

Yifeng has managed for these LDRD projects is approximately $6M. These projects have involved over 30 technical staff, university professors, and students. These projects have helped Sandia to secure external funding of about $3M. (e.g.,from DOE-OCRWM, YM S&T, DOE-NE Waste Separation/Waste Forms, National Science Foundation, and Japanese Ishikawajima-Harima Heavy Industries). Through these LDRD projects, time and time again Yifeng successfully integrated lab core capabilities with Sandia's mission needs. He is first at Sandia to formally apply nanoscience and microsensor technology to nuclear waste issues. On each of these projects, Yifeng leads and has led teams from multiple internal or external organizations, demonstrating an excellent technical leadership.

The scientific advances and technology innovations he made through these LDRD projects are remarkable. He is the first one in the world to demonstrate that the confined nanopore surfaces may exhibit different sorption properties as compared to the corresponding unconfined surfaces. He has further demonstrated that contaminants in natural systems tend to be enriched in nanopores and such mechanisms may directly control the bioavailability of contaminants in the environment.

He has developed a set of nanoporous oxide materials that outperform other existing materials for iodine sorption and immobilization (three patent applications were filed and two are in preparation). His paper on kinetic modeling of microbially-driven redox chemistry of subsurface environments (*Journal of Hydrology,* [*1998*], 209, 117-123) has been cited more than 166 times by journal articles and discussed in details in the textbook Ground-Water Microbiology and Geochemistry (Francis Chapelle/United States Geological Survey). His work on enhanced performance assessment systems for carbon sequestration is the first of its kind able to integrate a sophisticated optimization tool kit (design analysis kit for optimization, or DAKOTA) with a complex reservoir simulator (transport of unsaturated groundwater and heat, or TOUGH2). His work on sensor studies laid the foundation for potential uses of microsensor technology to identify, quantify and differentiate volatile organic compounds in transuranic radioactive wastes. Very recently, he and his colleagues discovered a new mechanism for iodide interaction with clay materials.



Yifeng examines a sedimentary outcrop in Tijeras Canyon, NM. Yifeng is the lead author of the paper published in Nature Communications that provides a new insight about the formation of self-organized porosity and permeability distribution in dolomite.

(Sandia Lab News, 5/18/2012; photo by Randy Montoya)

Service to Professional Societies and Communities

In his over 18 years at Sandia, Dr. Yifeng Wang has consistently shown his ability to build external contacts and directly work with external customers. For many of his projects, he closely collaborates and communicates with his DOE customers. He also provides technical guidance to colleagues at multiple national laboratories, coordinating their work and collaborating to ensure the completion of planned milestones as well as ensuring a high quality of

technical products. Over the years, Yifeng has interacted with various DOE and other customers (e.g., EPA, Nuclear Waste Technical Review Board, New Mexico State Environmental Evaluation Group, and National Academy of Science). On one occasion, Yifeng was asked to give a presentation to a Spanish diplomat on waste form development during the diplomat's visit to Sandia National Laboratories. In FY1999, he served as a member of the DOE-Carlsbad Office Technical Review Committee for National TRU Program Technology Development. In 2004 through 2007, he served as a member of the Yucca Mountain Project Independent Validation Review Team and the DOE In-Depth Review Team for Yucca Mountain Engineered Barrier Systems.

Yifeng has been asked by DOE customers to provide input to key documents or plans related to national nuclear waste management. For example, in FY2010, Yifeng helped to organize a workshop on the development of the DOE Used Fuel Disposition (UFD) Research & Development (R&D) Roadmap for U.S. waste disposal. Yifeng led the discussion on the natural system areas of the workshop. He wrote the section on natural system evaluation for the UFD R&D Roadmap.

Yifeng has been responsible for a number of international collaborations. He was specifically identified by a Japanese counterpart as an international expert in biogeochemical modeling. He was the principal investigator of the Sandia-IHI (Ishikawajima-Harima Heavy Industries Co., Ltd.) biogeochemical simulation project. He gave a keynote speech on the evaluation of microbial activity in deep geologic repositories at the Fourth International Symposium on Advanced Science Research – Advances in Heavy Elements Microbiology Research (ASR2004), held Nov. 15 and 16, 2004, in Tokai, Japan. Yifeng was also the point of contact at Sandia for international collaboration on repository gas generation studies. He represented Sandia to chair the session "Gas Generation – An Overview" for the International Workshop on "How to Treat Gas in Safety Assessments of a Radioactive Waste Repository," held Nov. 11 through 13, 2002, in Cologne, Germany. Yifeng also participated in the Swiss Grimsel Colloid and Radionuclide Retardation project. Currently, Yifeng is the technical point of contact of U.S./UFD-Korean Atomic Energy Research Institute collaboration on underground tunnel tests for nuclear waste disposal.

Over the years, Yifeng has developed a close collaborative relationship with a number of universities including Georgia Tech (Professor P. Van Cappellen, biogeochemistry), Indiana University (Professor E. Merino, geochemistry), University of Wisconsin at Madison (Professor H. Xu, mineralogy),

Yifeng examines a clay sample from South Dakota. Recently, he and his colleagues discovered a new mechanism for anion interaction with clays.

(9/6/2013, Sandia Lab News, photo by Randy Montoya)

University of New Mexico (UNM) (Formerly Dr. H. Xu and now Dr. Y. Jiang, material science), New Mexico State University (Professor S. Deng, chemical engineering), University of North Texas (Professor P.S. Braterman, chemistry), University of Aix-Marseille III, France (Professor D. Nahon, soil science), and Clarkson University (Professor I. Sokolov, physics). His collaboration with the UNM Transmission Electron Microscope (TEM) Lab is beneficial to R&D at Sandia, as indicated by over 30 joint publications. He was an adjunct associate professor in the department of Earth and Planetary Science at UNM. He and Prof. Xu were able to secure National Science Foundation funding for their research on nano-scale mineral phases. They successfully organized workshops on Nano-Structures in Environment & Technology. Yifeng was invited by University of Wisconsin (Madison) to give Lewis G. Weeks lectures on modeling extreme biogeochemical environments and biogeochemistry of deep geologic nuclear waste repositories. He was also invited by Indiana University to give a lecture on nanogeochemistry. Yifeng co-supervised a Ph.D. student at Georgia Tech (K. Hunter) and five students at the UNM-TEM lab by providing technical direction in their thesis research as well as attending their group meetings.

Yifeng is active in the scientific community. He is the editor-in-chief of American Institute of Mathematical Science's journal, *Environmental Science*. He was or is a member of Geochemical Society, Geological Society of America, American Geophysical Union, and Materials Research Society. He has been a reviewer for many international journals including *Geochimica et Cosmochimica Acta, Chemical Geology, Journal of Colloid and Interface Science*, *Journal of Geology, American Journal of Science, Soil Science, Geoderma, Journal of Physical Chemistry, Environmental Science & Technology, Journal of Hazardous Materials*, and *Radioactive Waste Management*. He has also been a proposal reviewer for National Science Foundation, DOE-Basic Energy Science, and DOE-NE.

He chairs or has chaired a number of international conference sessions:

1. Geochemistry and Reactive Transport in Shale Nanopores, 247th American Chemical Society National Meeting, Dallas, Texas, March 16 through 20, 2014.
2. Nonlinear Geophysics: General Contributions, American Geophysical Union Fall Meeting, Dec. 13 through 17, 2010, San Francisco, California.
3. Nonlinear Geophysics: Horizons, American Geophysical Union Fall Meeting, Dec. 13 through 17, 2010, San Francisco, California.
4. Nonlinear dynamics of Geochemical System, V. M. Goldschmidt Conference, June 13 through 18, Knoxville, Tennessee.
5. Nano-Phases and Nano-Structures in Earth Environments. Geological Society of America Annual Meeting, Oct. 5 through 9, 2008, Houston, Texas.
6. Frontier in Nanogeochemistry. 18th Annual V. M. Goldschmidt Conference, July 2008, Vancouver, Canada.
7. Nano-Geochemistry and Nano-Structures in Earth Systems. Geological Society of America Annual Meeting, Nov. 7 through 11, 2004, Denver, Colorado.
8. Gas Generation – An Overview, International Workshop on How to Treat Gas in Safety Assessments of a Radioactive Waste Repository, Nov. 11 through 13, 2002, Cologne, Germany.

Impact of Professional Accomplishments

Dr. Yifeng Wang is an internationally recognized geochemist and pioneer of nanogeoscience, geochemical self-organization and biogeochemical modeling, who has greatly enhanced Sandia's technical reputation in nuclear waste disposal, nanotechnology, geochemistry, and advanced modeling of complex systems. Because of his pioneering work in introducing nanoscience concepts into geochemical studies (Wang et al., "Nanogeochemistry: Geochemical reactions and mass transfers in nanopores," Geology, [2003] 31, 387-390), in 2008, Yifeng was invited by President Russell Harmon of the International Association of Geochemistry to give the keynote speech on nanogeochemistry at the quadrennial International Geological Congress. His work on banded iron formation was published in Nature Geoscience (Wang et al., "Generation of banded iron formations by internal dynamics and leaching of oceanic crust," [2009] 2, 781-784) and reported on the front page of *Sandia Lab News* (v. 61, no. 21). In this work, Yifeng for the first time demonstrated that the deposition of massive iron formations billion years ago could reflect the changing composition of the oceanic crust. The work has been hailed by scientific community as a major breakthrough in solving a long-standing geological puzzle. His recent work on self-organized porosity variations in dolomite was published in Nature Communications (3:685) and also reported by *Sandia Lab News* (v. 64, no. 9). In this work, Yifeng provided a first theoretical explanation for the emergence of structural heterogeneity in dolomite diagenesis, which has an important implication to petroleum reservoir characterization.

Yifeng has published over 80 peer-reviewed articles including journals such as *Nature Geoscience, Nature Communication,* and *Geology*). He has six issued or pending U.S. patents.

Patents

1. Method for absorbing an ion from a fluid, U.S. Patent No. 7,238,288, issued on July 3, 2007.
2. Method of making nanostructured glass-ceramic waste forms, U.S. Patent No. 8334421, Dec. 18, 2012.
3. Nanocomposite materials as getter and waste form for radionuclides and other hazardous materials (pending).
4. Advanced fire-resistant forms of activated carbon and methods of adsorbing and separating gases using same (pending).
5. Methods of capturing and immobilizing radioactive nuclei with metal fluorite-based inorganic Materials (pending).
6. Method for subsurface immobilization of supercritical carbon dioxide (pending).

Selected Journal Articles (over 80 peer-reviewed articles)

1. Wang, Y., Bryan, C., Dewers, T., Heath, J. E., and Jove-Colon, C., "Ganglion dynamics and its implications to geologic carbon dioxide storage," *Environmental Science & Technology,* (2012) dx.doi.org/10.1021/es301208k.

2. Wang, Y. and Budd, D. A., "Stress-induced chemical waves in sediment burial diagenesis," *Nature Communications*, (2012) 3:685 doi: 10.1038/ncomms 1864.
3. Wang, Y., Xu, H., Merino, E., and Honishi, H. "Generation of banded iron formations by internal dynamics and leaching of oceanic crust," *Nature Geoscience*, (2009) Vol 2, 781-784.
4. Wang, Y., Gao, H., Yeredla, R, Xu, H, and Abrecht, M., "Control of surface functional groups on pertechnetate sorption on activated carbon," Journal of. Colloid Interface Science, (2007) Vol 305, 209-217.
5. Wang, Y. and Gao, H., "Compositional and structural control on anion sorption capability of layered double hydroxides (LDHs)," *Journal of Colloid and Interface Science*, (2006) Vol 301, 19-26.
6. Wang, Y., Bryan, C., Xu, H., and Gao, H., "Nanogeochemistry: Geochemical reactions and mass transfers in nanopores," *Geology*, (2003) Vol 31, pp 387-390.
7. Wang, Y., Bryan, C., Xu, H., Pohl, P., Yang, Y. and Brinker, C. J., "Interface chemistry of nanostructured materials: Ion adsorption on mesoporous alumina," *Journal of Colloid and Interface Science*, (2002) Vol 254, 23-30.
8. Hunter, K., Wang, Y., and Van Cappellen, P., "Kinetic modeling of microbially-driven redox chemistry of subsurface environments: Coupling transport, microbial metabolism and geochemistry," *Journal of Hydrology*, (1998) Vol 209, 53-80. (166 citations)
9. Wang, Y. and Van Cappellen, P., "A multi-component reaction-transport model for early diagenesis: Application to redox cycling in coastal marine sediments," *Geochimica et Cosmochimica Acta*, (1996) Vol 60, 2993-3014. (166 citations)
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Book Chapters

1. Wang, Y., Gao H., Miller, A. & Pohl, P. "A new generation of adsorbent materials for entrapping and immobilizing highly mobile radionuclides," X.-Y. Yu ed., *Municipal and Industrial Waste Disposal*, InTech, (2012) 99-118. (Downloaded more than 1,500 times)
2. Wang, Y., Gao, H. and Xu, H. "Nanogeochemistry: Nanostructures and their reactivity in natural systems," A. Parker and H. Russell, eds., *Frontiers in Geochemistry*, Wiley-Blackwell, (2011) 200-220.
3. Merino, E. and Wang, Y. "Geochemical self-organization in rocks: Occurrences, observations, modeling, testing – with emphasis on agate genesis," Han-Jürgen Krug and Jörn H. Kruhl, eds, *Year-Book for Complexity in Natural, Social, and Human Sciences: Vol. 11, Non-Equilibrium Processes and Dissipative Structures in Geoscience*, Duncker & Humblot, Berlin, (2001) 13-45.

Recent Invited Speeches

12/2012 Nanogeochemsitry: Size-dependent mineral-water interface chemistry, American Geophysical Union Fall Meeting, Dec. 3 to 7, 2012, San Francisco.

12/2010 Nanostructures and radionuclide transport in clay formations, American Geophysical Union Fall Meeting, Dec. 13 to 17, 2010, San Francisco.

10/2010 Keynote speech: Size-dependent mineral-water interface chemistry: An overview. 2010 Geological Society of America Annual Meeting, Oct. 31 to Nov. 3, Denver.

8/2008 Keynote speech: Nanogeochemistry: Nanophases, nanostructures and their reactivity in natural systems, Thirty-third International Geological Congress, August 6 to 14, 2008, Oslo, Norway.

5/2005 Nanogeochemistry: Geochemical reaction in nanopores, Fifteenth Annual Goldschmidt Conference, May 20 to 25, 2005, Moscow, Idaho.

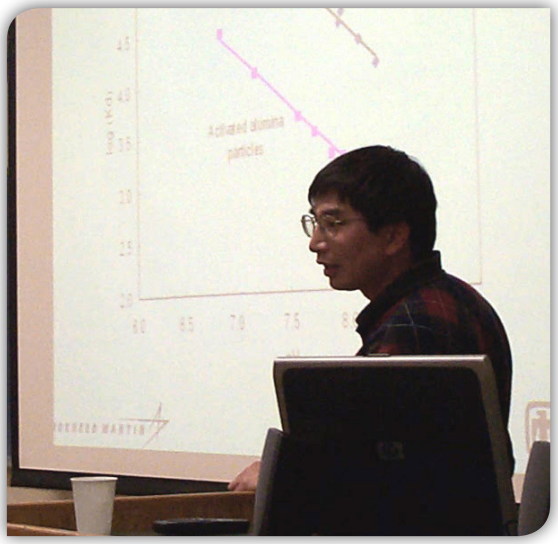
9/2007 Lewis G. Weeks Lectures: (1) Modeling extreme biogeochemical environments; (2) Biogeochemistry of deep geologic nuclear waste repositories, University of Wisconsin-Madison.

3/2005 Geochemical reactions and mass transfer in nanopores with consequences for aqueous components and contaminants, Indiana University, Bloomington.

11/2004 Geochemical implications of nanometer-scale pores in natural materials. Geological Society of America Annual Meeting, Nov. 7 to 11, 2004, Denver.

10/2004 Potential applications of nanostructured materials in nuclear waste management, New Mexico State University, Las Cruces.

11/2004 Keynote speech: Evaluation of microbial activity in deep geological repositories: Technical basis and modeling approach, Fourth International Symposium on Advanced Science Research – Advances in Heavy Elements Microbiology Research (ASR2004), Nov. 15 to 16, 2004, Tokai, Japan.



Yifeng gave a lecture at the Workshop on Nanostructure in Environment & Technology (NANOSET) at the University of New Mexico in 2004.

Community Service

Dr. Wang is a steady volunteer at local schools and community organizations. These include:

- Board member of New Mexico Association of Engineers and Scientists (ACES) (2011 through 2013): Organized the technical seminar for 2012 Asian American Engineer of the Year ceremony that was very well received by approximately 80 participants; helped with organizing ACES annual meetings and picnics.
- Chair of Young Student Award Selection Committee for New Mexico Association of Engineers and Scientists (2012 and 2013): Coordinated with high schools in the greater Albuquerque area, assembled the selection committee, and presented the awards to the selected students at ACES annual meetings. Under his leadership, the award was expanded from Chinese American to Asian American students, increasing the impact on Asian American communities.
- Mentor of Albuquerque Academy Supercomputing Challenge teams (2008 and 2009): Led the teams to win third place in the state and a Rising Star award.
- Host family of Albuquerque Academy international students (2009).
- President of Cherry Hills Toastmaster Club (2011): Under his tenure, the club became one of a few select distinguished clubs.
- Vice president of Education for Cherry Hills Toastmaster Club (2010).
- Presentation on "China Today" to Albuquerque Academy history class.
- Judge for Carlsbad, NM public school science fair.
- Volunteer for Carlsbad, NM playground project.
- Actively participating Sandia's Asian Leadership and Outreach activities.
- Mentored two post-doctoral fellows and four student interns at Sandia, with one post-doc becoming a university professor and one becoming a Sandia staff member.

Yifeng and Jianjun hosted a visiting student, Aonan Zhao, from China for the Albuquerque Academy in 2009.

Yifeng organized a technical seminar session at 2012 AAEOY Ceremony. He presented an appreciation certificate to the featured speaker Professor C. Jeffery Brinker.

Letters of Recommendation

EARTH SCIENCES DIVISION

Hui-Hai Liu, Ph.D.
Staff Scientist
Earth Sciences Division
Lawrence Berkeley National Laboratory
Berkeley, CA 94720

Sept. 16, 2013

Award Selection Committee,
Chinese Institute of Engineers – USA (CIE/USA)

RE: Nomination of Dr. Yifeng Wang to be an Asian American Engineer of the Year (AAEOY)

Dear AAEOY Award Selection Committee:

I am writing to you to strongly support the nomination of Dr. Yifeng Wang to be an Asian American engineer of the Year.

I am a Staff Scientist at Lawrence Berkeley National Lab (LBNL) and a former head of its hydrogeology department consisting of about 80 researchers. I am also a recipient of Emil Truog Research Award from Soil Science Society of America and an elected fellow of Geological Society of America. As a hydrogeologist and modeler interested in interactions between physical and chemical processes in the subsurface, I have followed Dr. Wang's work for a long time since he published with van Cappellen the classic work on biogeochemical modeling in 1996. I started to have direct professional interaction with him about four years ago when he served as the natural-system tech lead for DOE Used Fuel Disposition Campaign (UFD) and I acted as the LBNL's point of contact for UFD. This allows me to know more about Dr. Wang beyond his scientific creativity and reputation.

Dr. Wang is an internationally recognized geochemist and one of the most scientifically creative scientists/engineers in earth sciences areas (at least in the DOE national-lab system) who I have known in my career. He is a pioneer of recently emerging geochemical research areas including nanogeochemistry (e.g., Geology, 2003, 31, 387-390), nonlinear geochemical dynamics (e.g., Nature Geoscience, 2009, 2, 781-784) and biogeochemical modeling (e.g., Wang and Cappellen, GCA, 1996). He is the first scientist demonstrating that nanopore confinement can potentially affect contaminant transport in subsurface system. He is also the first one applying far-from-equilibrium thermodynamics to the precipitation of banded iron formations (BIFs), which is

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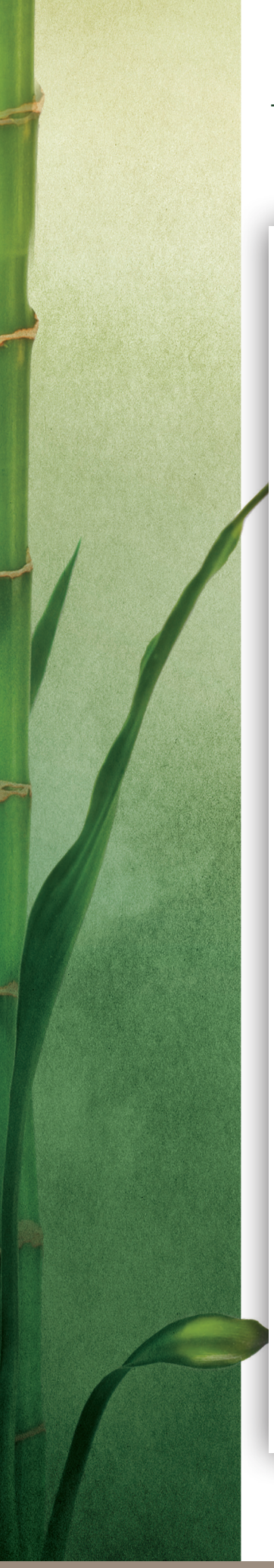

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EARTH SCIENCES DIVISION

century old puzzle in geology! His research focuses on both very fundamental levels of geochemistry and potential practical solutions to issues related to remediation of subsurface contamination and nuclear waste management. Especially, he has played an important role in and made outstanding contributions to attacking one of the most challenging environmental issues, disposal of high-level nuclear waste. His scientific contributions and impacts are also partially demonstrated by high citations of his work, as shown in ISI Web of Knowledge. For example, his three papers (mainly with van Cappellen) on biogeochemical modeling have total citations of more than 600 at this point!

As the natural-system technical lead for UFD, Dr. Wang has demonstrated very strong technical leadership and excellent project management skills. He has a special talent to identify key scientific issues from complex applied problems like nuclear waste disposal in different geological environments and to be able to develop with his team essential technical and practical pathways to attack these key issues. He definitely belongs to the class of technical leads and/or project managers who have both clear vision of big pictures and detailed knowledge of technical issues. He also has a very impressive capability to deal with different opinions in unusually calm, impartial, and professional manners. For the UFD work, he has provided overall technical guidance with clearly defined objectives for teams from several participating national labs, developed detailed project plans, and communicated these guidance/plans to his team members, and coordinated the natural system work across multi-labs with excellent technical judgments. Thus, it is not surprising that he has been able to get the best out of his team members from different labs. As I know, Dr. Wang is a key player to develop a report on UFD R&D road map that is expected to have a significant long-lasting impact on future of the geological repository science in USA. Finally, I found that Dr. Wang has a very nice personality and easy to work with.

In Summary, Dr. Wang is an internationally recognized scientist/engineer with admirable accomplishments in both scientific discoveries and engineering studies of the most challenging environmental issues facing humankind. In addition, he is an excellent and capable tech leader, a quality that is especially valuable for the Asian American community. I have no doubt that he should be strongly qualified for AAEOY. If you have any further questions regarding my recommendation, please directly contact me at (510) 486-6452 (phone) or hhliu@lbl.gov (email).

Sincerely yours

Hui-Hai Liu

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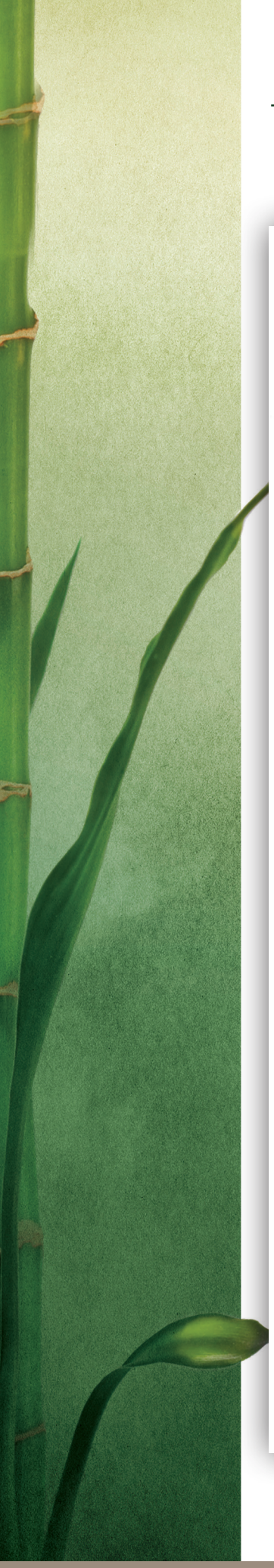

Sandia National Laboratories
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Senior Scientist

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September 14, 2013

To: Award Selection Committee, Chinese Institute of Engineers

Dear Committee Members,

I give my highest recommendation to Dr. Yifeng Wang for Asian American Engineer of the Year because of the signal contributions Dr. Wang has made to the cleanup and treatment of radioactive contamination, the licensing of nuclear waste repositories; and for pioneering new principles of nanotechnology and global geochemistry. Dr. Wang's repeated application of fundamental technical insight to solve complex real-world problems exemplifies the engineering science tradition established by Ben Franklin, Zhang Heng, Archimedes, and others.

Over the past 25 years Dr. Wang has contributed mightily to advancing our understanding of nuclear waste treatment and storage and nanogeochemistry, and to cultivating the next generation of engineering scientists. While playing a central role in developing the technical basis for nuclear waste storage at the Waste Isolation Pilot Plant and the proposed nuclear waste repository at Yucca Mountain Dr. Wang produced 6 published and pending patents and 80 peer-reviewed publications. His contributions to building the local engineering science community have been exemplary.

Dr. Wang's deep technical impact in multiple fields is formidable and unmatched in my opinion. He is an inspiration to me personally, and I urge you to consider Dr. Wang's nomination in the most serious manner.

Please do not hesitate to contact me for further elaboration.

Patrick V. Brady
Senior Scientist

September 18, 2013

To: The Award Selection Committee
Chinese Institute of Engineers -USA (CIE/USA)

It gives me great pleasure to support Dr. Yifeng Wang's nomination for the 2014 Asian American Engineer of the Year (AAEOY) Award.

I have known Dr. Wang for eighteen years. I worked at the Sandia National Laboratories for 21 years in Albuquerque, New Mexico and retired in 2002 to serve as the Director of Office of Civilian Radioactive Waste Management (OCRWM) at the Department of Energy (DOE) as a Presidential Appointee from 2002 until 2005 in Washington DC. While I was at the Sandia National Laboratories, I was the Director of Nuclear Waste Management Center responsible for all the work related to nuclear waste management and disposal, and while I was at DOE/OCRWM I was in charge of the management and disposal of all civilian high-level waste and spent nuclear fuel in the United States. Yifeng worked directly in my Center at Sandia National Laboratories and indirectly within the Yucca Mountain program under OCRWM when I was at the DOE. Therefore, I believe that I am in a position to provide an informed assessment of Dr. Yifeng Wang's scientific/ technical achievements and their impact to the US as well as international nuclear waste policies and practices.

I first knew Yifeng Wang when I was the Deputy Manager of Technical Integration for Waste Isolation Pilot Plant (WIPP) in 1995. At the time, WIPP was in the process of preparing for the submission of long-waited Compliance Certification Application – essentially the license application to the Environmental Protection Agency (EPA) for the opening of the deep geologic repository for the disposal of defense-related transuranic wastes. As you may be aware, the disposal of nuclear waste is a politically controversial issue. But more importantly, the technical issues were very complicated; and it was the first ever attempt in the world to demonstrate the long-term (over 10,000 years) safety of a geologic repository. It is in this context that I want to describe to you what the role Yifeng was in and his contribution to the success of WIPP.

During the later stage of the WIPP project, external review teams raised the issue of the potential long-term impacts of gases produced by microbial activities in the repository. This issue could become a "life or death" trigger for the demonstration of the safety of the repository. Yifeng Wang was on the Disposal Room Chemistry Team of the WIPP project. I already noticed his outstanding technical strength at the time; therefore, I assigned him to tackle the problem. Rather than trying to rebut this issue, Yifeng proposed an innovative idea of utilizing MgO to control near-field chemistry and absorbing the gases. He designed theoretical as well experimental work to demonstrate the effectiveness of the concept. The idea was brilliant and the proof was flawless. This excellent piece of work convinced the technical communities --including the highly prestigious Academy of Sciences review team, and contributed very significantly to the ultimate approval of WIPP by the EPA. The MgO backfills have been in use since the opening of WIPP and has become an important part of the WIPP operation.

Yifeng continued using his excellent technical mind and innovative approach after WIPP. He participated in the next repository program – Yucca Mountain while I was in charge of the program at the DOE and contributed significantly as the technical lead of the repository chemistry. At the same time, he started several new ideas in the application of nanogeochemsitry to waste management under DOE OCRWM's Science and Technology Program. He demonstrated the potential of using nanomaterials for radionuclide separation and immobilization. He was also the first one to demonstrate that radionuclides may behave differently in nanopores, and developed

nanomaterials for off-gas treatment for fuel reprocessing – a long-standing issue for reprocessing facilities. Yifeng's nanomaterials work is original, creative and with wide potential applications. Of the six patents that he received and pending, several are from the nanomaterial work.

For the past eight years, I have been an independent consultant providing advices on nuclear-related issues. At times I would seek out technical information and advices from Yifeng; therefore I am familiar with his recent accomplishment. He has continued his outstanding and creative work at the Sandia National Laboratories in a variety of nuclear fuel cycle programs. I am especially impressed by his continuing work in the applications of material science in nuclear technology within the Laboratory Directed Research and Development (LDRD) program. LDRD are internally funded research projects within national laboratories to explore potentially high-impact new concepts. These projects are highly competitive and only the best ideas are funded. Yifeng Wang has demonstrated his creativity by repeatedly receiving funding under the LDRD.

From my close association with Yifeng during the WIPP years, and later on the Yucca Mountain project, I found him highly intelligent, creative, insightful, dedicated, and a great team player. He has the rare ability of bringing fundamental technical understanding and knowledge into complex real-world applications. I believe his success is a reflection of his deep understanding of the science of geology, chemistry, and physics, plus his constant and enthusiastic pursue of current scientific discoveries.

Yifeng is active in the scientific community. He is a member of Geochemical Society, Geological Society of America, American Geophysical Union and Materials Research Society. He has been a reviewer for international journals; chaired many international conference sessions and given numerous invited or keynote speeches. Yifeng is very active in community services: he is a Board Member of CIE/USA-NM; he served as Mentor of Albuquerque Academy Supercomputing Challenge teams; as President of Cherry Hills Toastmaster Club (2011) the club became one of a few select distinguished clubs; and he has been a sought after mentor at Sandia for post-docs and student interns, with one post-doc becoming a university professor and one becoming a Sandia staff.

I have known several AAEOY winners over the years; I believe Dr. Yifeng Wang's technical achievements, his contributions to the scientific community and his extensive services to the community exemplify the essence of the Asian American Engineer of the Year (AAEOY) Award. I give my very highest recommendation for his nomination.

Sincerely,

Margaret S.Y. Chu, Ph.D.
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Yifeng giving a lecture earlier in his career.

U.S. DEPARTMENT OF ENERGY

National Nuclear Security Administration

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