Inaugural Newsletter

News and information from the EMS Energy Institute.

Welcome to Peter Flemings

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The Energy Institute is proud to welcome Peter Flemings, professor of Geosciences, to our research team. Flemings? current research interests include basinal fluid flow, hydrogeology, basin analysis, and stratigraphy. His research couples observation with theoretical analysis to study crustal fluid flow at human and geologic timescales.

Flemings does a significant amount of work with the oil industry and the International Ocean Drilling Program (IODP). He co-led an IODP expedition last summer for six weeks in the Gulf of Mexico to investigate the properties and features that must exist for sub marine stress and landslides to occur. Current projects with IODP include the study of fluid pressure in the Nankai Accretionary Prism, analysis and modeling of hydrate systems on southern Hydrate Ridge, the study of slope stability on continental margins, and the development of a pore pressure penetrometer for ocean drilling.

The GeoSystems Initiative is a Master?s Degree initiative co-directed by Flemings and professor Turgay Ertekin that links Geosciences, Petroleum Engineering and Industry. In addition, Flemings also oversees the Penn State GeoFluids Consortium: an industry consortium started in 2004 that focuses on pore pressure and related fields. He and colleagues in geosciences and geoenvironmental engineering are developing a new effort called the ?G3 Center? or the ?Center for Geomechanics, Geofluids and Geohazards,? which is a cohesive and coherent group of researchers at Penn State who work at the interface of science and engineering and focus on geomechanics, geofluids and geohazards.

Chunshan Song Faculty Spotlight

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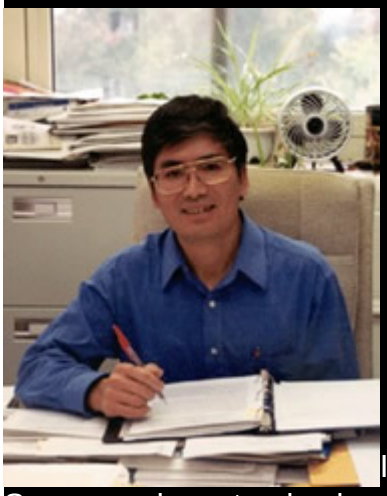 In defining the two most important products of Penn State, Chunshan Song speaks not only about the university?s research accomplishments, but also about its people. ?One very important aspect is working with graduate students, post-doctorates, research associates, and faculty collaborators,? Song says. ?I enjoy that very much.?

Song is the director of the Clean Fuels and Catalysis Program in the Energy Institute and a professor of fuel science in the Energy & Geo-Environmental Engineering Department at Penn State.

At the Energy Institute, he leads a number of energy research activities. One of his most important research endeavors is ultra clean fuel processing. This research focuses on how to produce ultra clean fuels more efficiently by removing harmful pollutants like sulfur, nitrogen, and polyaromatic hydrocarbons.

?The future supply of clean fuels and chemicals, and environmentally friendly fuel processing and chemical manufacturing are of deep concern to us,? Song says.

When automobile engines burn the liquid fuels or when power plants burn coal and petroleum, the sulfur in these fuels will be released as sulfur oxide. The sulfur oxide, in turn, responds to water and oxygen in the atmosphere to produce sulfuric acid, a major contributor to acid rain and air pollution. Conventional methods of removing sulfur from liquid fuels involve applying high temperatures and high pressures in a process called hydrodesulfurization using pressurized hydrogen gas and a catalyst.

?The world is growing hungrier for energy. Resources are getting lower in quality,? explains Song. ?The product coming in the door is dirtier than before, but the product being demanded is cleaner and cleaner.?

Song and his research team at Penn State have developed a novel way of desulfurization called selective adsorption for removing sulfur (PSU-SARS). In this method, that does not use hydrogen, sulfur compounds are removed at room (ambient) temperatures. The result is a more

efficient, ultra clean fuel that can be used as a transportation fuel for jets, gasoline for cars, and diesel for buses and trucks.

In fact, Penn State has filed two patents for the new desulfurization process, called the selective adsorption for removing sulfur, which was developed in Song?s lab at the Energy Institute as a result of this research. Song and his co-workers and students are very excited.

?What was once a simple idea has become a promising path for desulfurization,? Song says of the research, which was initially proposed to the U.S. Department of Energy in 1999 and has taken off ever since. His current co-workers and students on desulfurization research includes Xiaoliang Ma, Shingo Watanabe, Fuxia Sun, Ramnathan Sundramen, Jennifer Clemons, Jae Hyung Kim, Xiaoxing Wang, Jiahua Guo, Nicole Reed, Boonyawan Yoosuk, Cigdem Shalaby, and Mamoru Fujii.

Song has published over 200 papers, has delivered over 170 invited lectures around the world, and has received a number of awards for research. Most recently, he received the 2005 Cheung Kong (Chang Jiang) Scholar Award from the Ministry of Education in China.

In addition to ultra clean fuel processing, Song identifies three other major areas of his research activity at the Energy Institute: 1) fuel cell fuel processing, 2) shape selective catalysis for synthesis of value-added chemicals, and 3) heavy oil processing and coal conversion.

Song notes that collaboration is a key aspect in all of his research areas. He works with multiple agencies including the U.S. Department of Energy, the U.S. Department of Defense, the U.S. Environmental Protection Agency, and the Pennsylvania Energy Development Authority (PEDA). He also works with a number of industry partners such as Altex Technology, ConocoPhillips, BP, Air Products, and Engelhard..

Song holds a B.S. degree in chemical engineering from Dalian University of Techonolgy in Dalian, China, and received both an M.S. and a Ph.D. in applied chemistry from Osaka University in Japan in the late 80s. He worked in the research center of the Osaka Gas Company before coming to Penn State in Nov 1989.

Not one to take all the credit, Song points out that his students and post- doctoral coworkers deserve much of the credit for the real work carried out in his research labs.

?We train students to become contributors by solving the important problems in society, Song notes. ?I have a deep appreciation for them and also see it as my duty to nurture their growth.?

New Center Serves as Focal Point for Biomass Research at Penn State

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Biomass research at Penn State has traditionally taken place within four colleges: Agricultural Sciences, Earth and Mineral Sciences, the Eberly College of Science, and Engineering. While these programs have made significant individual contributions to biomass energy research, they

are now being brought together under one interdisciplinary research center with the goal of maximizing efforts.

The Penn State Biomass Energy Center was officially launched in August to coordinate and facilitate research and outreach across the university, building teams to address the complete value chain of biomass energy systems.

Tom Richard, associate professor in agricultural and biological engineering, first proposed the center back in June to be created within the Environment and Natural Resources Institute under the umbrella of the Penn State Institutes of the Environment. The project was conceived as a university-wide effort, and involves faculty from all colleges involved in biomass research.

Richard says he saw the center as a way to provide a better focus and an opportunity for synergy among researchers across campus.

?It became clear that there was a lot of biomass-related activity on campus, but it wasn?t well coordinated,? he says. ?Biomass energy systems are complex and the solutions are complex. Sucessful solutions will require a lot of people applying knowledge and skills from many backgrounds. The Center will provide a mechanism to facilitate this type of interdisciplinary research.?

Presently, the center is focused on four main categories: 1) biomass feedstock production, 2) sustainable bioenergy systems, 3) biomass conversion to energy, and 4) technology transfer to companies, state agencies, NGOs, and citizens throughout the Commonwealth and beyond.

Biomass conversion technologies in particular have become of special interest to many Pennsylvanians since March of 2006 when Governor Ed Rendell announced he was endorsing the ?25 x 25? campaign, which is striving to achieve a 25 percent reliance on renewable energy resources, like biomass, by the year 2025.

?We have a fair amount of confidence that technical solutions will come,? he says. ?There is nothing in that goal that is not achievable if we have the political will to invest in the needed research, education, and outreach.?

Currently, the Energy Institute has several research activities listed on the Biomass Energy Center?s Web site that relate to biomass, including topics such as carbon sequestration, biodiesel/bio-oils, microbial fuel cells, combustion and gasification, bio-hydrogen, biocatalysis, and integrated biorefineries.

In addition to highlighting biomass research efforts across campus, the center will serve as a vehicle for outreach and education. Richard says that those looking for assistance will be able go to a single source to access the breadth of expertise and resources on campus. The center will also work to bring in leading scholars in the biomass energy field to speak on campus.

Read the full story on Penn State News [9]

David J. Clifford

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 The Energy Institute at Penn State is sad to announce the passing of Dr. David J. Clifford, 38, of State College, who died Sunday, September 10, 2006, at his residence. He will be greatly missed by his colleagues.

Dr. Clifford joined the Energy Institute in 1998 as an analytical chemist, where he managed the maintenance and upkeep of chromatography and spectroscopy equipment and trained students and staff on its use. He participated in laboratory courses and assisted students and faculty in performing research and data interpretation. Before coming to Penn State, he worked at the Oceanographic Institute of Research in the Netherlands and at the Argonne National Laboratory in Chicago. He was a member of the American Chemical Society

Dave was born in Pottsville, Pa., in 1967 to John H. and Catherine Callaghan Clifford, of Ashland. He received a B.S. from Wilkes University, an M.S. from Penn State, and a Ph.D. in material science and engineering (fuel science) from Penn State.

At the Energy Institute, Dave was reunited with his former college friend turned coworker Caroline Burgess. He and Caroline were married on August 23, 2003. A member of the Trinity Lutheran Church, he played in the bell choir and was a Trinity Wheelman. He enjoyed mountain and road biking, gardening, cooking, tailgating, traveling, and the outdoors in general, and was a triathlete. He was also a regular member of Weight Watchers.

High School Students Prepare for Science-Related Careers through Summer Study Program with EMS Faculty

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It?s not everyday that high school students get to research the gasification of biomass, explore the art of catalysis, or conduct delayed coking experiments. But for 63 teenagers who were involved in the 2006 Penn State Summer Experience in Earth and Mineral Sciences (SEEMS), these topics were exactly the kind of scientific concepts they had the opportunity to research this summer.

SEEMS is a five-week residential program for students in grades 9-12, taught by faculty and graduate students in the College of Earth and Mineral Sciences to provide hands on research experience in a laboratory setting. The Energy Institute has been involved with SEEMS since the program started four years ago.

Meredith Hill, a graduate student in the Energy and Geo-Environmental Engineering Program, served as Education Coordinator of SEEMS this year.

?I was mostly impressed with their work ethic and presenting abilities,? Hill said. ?I kept forgetting that they were only in high school!?

SEEMS is sponsored by the Upward Bound Math and Science Center (UBMS) at Penn State, which aims to help high school students in recognizing and developing their potential to excel in math and science. The program is available for all students through out Pennsylvania, but has a special relationship with five target schools in urban school districts in the state.

?I think the fact that the students get to work in a real laboratory on real research was exciting for them,? Hill said. ?The majority of the students come from schools that may have very weak math and science programs...I really think this experience helped them develop their confidence overall.?

Participants of the Upward Bound program are encouraged to pursue postsecondary degrees in

scientific and mathematical fields. Currently, the program at Penn State has a 100 percent postsecondary education acceptance rate and a 100 percent high school graduation rate for their participants.

Energy Institute research associates Parvana Aksoy and Omer Gul, along with graduate student Maria Escallon, led a SEEMS workshop this year called ?Delayed Coking of Coal/Decant Oil and Characterization of Products.?

In the course, students were introduced to the concept of delayed coking of coal and decant oil. They evaluated solid and liquid samples from co-coking and were also trained to operate a simulated-distillation gas chromatograph analyzer to determine gasoline, jet fuel and diesel.

At the conclusion of the program, students are required to write a research paper and present their results to their peers, advisors and judges. Aksoy said it was difficult for students to grasp some of the concepts at first, but in the end they took away a very good understanding and an increased interest in science.

?The most important thing was that the students were doing the experiments on their own,? she said.

Upcoming Events

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December 14 : Join Friends of the Earth and Mineral Sciences Museum and Art & Mineral Gallery in the Ground Floor of Deike Building for the OPENING of New Exhibits Food, Friendship, and Fun from 4:30-6:45pm.

January 6-13: The 2007 Pennsylvania Farm Show will take place at the Farm Show Complex in Harrisburg. Admission is free for all events except the Thursday, Friday and Saturday PRCA Circuit Finals Rodeo located in the Large Arena during Farm Show Week.

March 25-29: The American Chemical Society will hold its 233rd National Meeting and Exposition in Chicago, Illinois.

June 10-15: The Clearwater Coal Conference will be held at the Sheraton Sand Key Resort in Clearwater, Florida. Abstracts are due January 19, 2007.

Contracts/Grants

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The Energy Institute received more than $3.7 million in contracts and grants in the first quarter of the fiscal year.

Boehman, Andre; Santoro, Robert; Litzinger, Thomas, Perez, Joseph M.; Examination of Diesel Soot Characteristics that Lead to Undesirable Interactions with Lubricants and Lubricant

Additives, Infineum USA L.P.

Burgess-Clifford, Caroline; Mitchell, Gary; Gul, Omer; Delayed ?Coking of Commercial Solvents, Alcoa

Elsworth, Derek; **Marone, Chris**; Quantifying the Physical and Chemical Controls on Permeability Evolution in Sheared Fractures, National Science Foundation

Grader, Avrami; Cyclic Processes Within Surface-Exposed Fractures Affecting Evaporation and Salinization Mechanisms, National Science Foundation

Grader, Avrami; CQI Scanning, Exponent

Lvov, Serguei; Alternate Thermochemical Cycles for Producing Hydrogen, Argonne National Laboratory

Schobert, Harold; Advanced Thermally Stable Coal-Based Jet Fuels, Air Force Office of Scientific Research