NETL-RUA
Regional University Alliance

E NEWS

Shared Intellect • Shared Laboratories • Shared Resources

October 2012
VOLUME 2, ISSUE 9

2ND ANNUAL ENERGY & INNOVATION CONFERENCE

The NETL-RUA 2012 Fall Conference

On November 28 and 29, 2012, NETL-RUA is teaming up with Catalyst Connection at the Southpointe Hilton Garden Inn in Canonsburg, Pennsylvania, to showcase NETL-RUA research capabilities and innovation success stories to the region's manufacturing sector and to facilitate the development of new partnerships for future collaborative research.

Catalyst Connection, an economic development organization dedicated to helping regional manufacturers improve their competitive performance, has teamed with NETL-RUA to lead a unique forum for bringing like-minded researchers from NETL-RUA and industry together to pursue collaborative opportunities.

The presentations at this conference will focus on capabilities embodied in research that can be applied to solve industrial problems or accelerate technology development with industrial participation. For that reason, speakers have been requested to provide a *technology commercialization brief* or *capabilities overview* rather than a technology presentation. This conference is an opportunity for our Alliance researchers to underscore the collective capabilities of the NETL-RUA to the region and thus improve the visibility of the NETL-RUA as a powerful vehicle to drive innovation energy and environmental research. The conference will also afford

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NETL-RUA METRICS SNAPSHOT

PRODUCTS		
	FY2011	FY2012
Publications	194	70
Patents	11	2
Licenses	9	4
Students Graduated	20 PhD	23 PhD
	8 MS	18 MS

Product data is updated quarterly.

RESEARCH PERSONNEL

Total = 529
- Graduate Students – 105
- Undergraduate Students – 10
- University Researchers – 185
- URS Researchers – 80
- NETL Researchers – 149

E News is your monthly source for the latest information about NETL-RUA's research, activities, and other important news. If you have information that you would like to feature in future newsletters, send that information to

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What's in This Issue

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industry presenters a forum in which to outline R&D needs and technological trends in their respective market sectors that might provide opportunities for new collaborations with NETL-RUA researchers.

Catalyst Connection will lead sessions focused on business resources and best practices around innovation commercialization to further assist these partnerships in accelerating the deployment of new technology. A variety of keynote speakers will address the region's rich history of energy innovation, current energy trends and issues, and results of a study on improving manufacturing competitiveness.

For more information on the technical, business, and educational tracks; keynote speakers; and registration, please visit http://netldev.netl.doe.gov/events/energy-innov-conf

Note on Attendance: All NETL-RUA members are invited to attend this meeting; however, ***because of new restrictions issued by the White House Office of Management and Budget (OMB) on conference attendance, there are a limited number of attendees whose travel can be paid with NETL funds.*** Those invited to speak, present, or chair sessions are approved to use NETL funds to reimburse travel and registration fees provided they follow the necessary request and approval process. All others who wish to attend should follow your organization's travel request and approval process to obtain other sources of funding for travel reimbursement. NETL employees are required to request attendance through their supervisor and are also subject to the OMB limitations on conference attendance.

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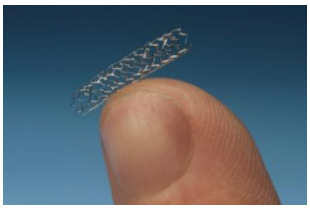
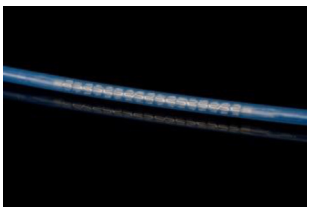
NETL Team Wins High Award from Secretary of Energy

NETL's coronary stents team, Paul Turner and Paul Jablonski of NETL and Ed Argetsinger of URS, earned a Secretary of Energy Achievement Award for their work in formulating a unique platinum-chromium alloy used for new-generation coronary stents.

Developed with Boston Scientific Corporation, Inc., the stents are so superior to older-model stents that they have quickly captured nearly half the U.S. market. Titled "Novel platinum chromium alloy for the manufacture of improved coronary stents," the alloy makes stents that are stronger, thinner, more flexible, and easier to see via x-ray than previous stainless stents.





The coronary stents were first approved for sale in Europe in the fall of 2009 and have gone on to capture 33 percent of the world's market with sales totaling more than $4 billion. Moving beyond coronary use, this alloy has recently been approved in Europe for use in peripheral stents—those used to repair damaged blood vessels in extremities (legs and arms)—and it is expected that these same stents will be approved for marketing in the United States within the next few months.

In 2012, the new alloy earned a technology transfer award for Excellence in Technology Transfer from the Federal Laboratory Consortium for Technology Transfer and a prestigious R&D 100 Award, given by *R&D Magazine* each year to recognize the very top high-technology products of the year, was received in 2011.

Each year, the Secretary of Energy hosts a special ceremony to honor individuals or teams who have accomplished successes above and beyond expectations. The Secretary's Honor Awards, given annually, represent the highest level of internal non-monetary recognition for DOE employees.

For more information about the stent:

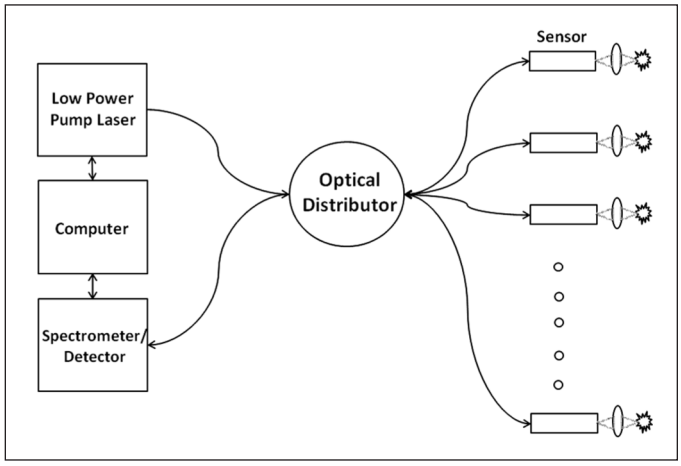
http://www.netl.doe.gov/publications/press/2012/120508_stent_technology.html

Laser-Induced Breakdown Spectroscopy (LIBS) Research at NETL

On August 6, 2012, the world watched the landing of the Curiosity rover on the surface of Mars. What many people do not know is that among several sophisticated detection devices, the rover is equipped with a laser-induced breakdown spectroscopy (LIBS) instrument called ChemCam. LIBS is a laser-based analytical technique that provides rapid elemental and isotopic analysis of solid, liquid, and gas samples. On Mars, the instrument is monitoring the elemental composition of the surface (soil, rock, etc.) and the atmosphere. Within ChemCam, the LIBS system is coupled with Raman spectroscopy to measure molecular species. ChemCam was fabricated at Los Alamos National Laboratory where NETL-RUA members Dustin McIntyre (NETL) and Jinesh Jain (URS) had the opportunity to view the unit prior to its shipment to NASA.

LIBS is a versatile measurement technique that can be applied to multiple measurement modalities and simply needs some engineering and refinement to become a highly useful portable system for routine, widespread monitoring. NETL-RUA researchers are using LIBS for carbon sequestration monitoring and measurement. This setup essentially comprises a high intensity laser as an excitation source and a time-gated spectrometer to collect the signal. Generally, a laser beam is focused onto a solid sample or within a gaseous or liquid sample to create high temperatures, dissociating the sample to form plasma. Radiation from the plasma is then collected by the spectrometer. Subsequent analysis of the radiation gives qualitative and quantitative information of chemical elements present in the sample. The technique's versatility has also allowed NETL researchers to use LIBS for developing calibration standards to aid CT scanning technology, and this work won a best paper (co-authors Dustin McIntyre and Jinesh Jain pictured at left) award last year from the Society of Petroleum Engineers (SPE) in Denver, Colorado.

The application of LIBS in carbon sequestration research led NETL to submit a patent disclosure (Steve D. Woodruff, Dustin L. McIntyre, and Jinesh C. Jain, ***A Method and Device for Remotely Monitoring an Area Using a Low Peak Power Optical Pump,*** patent application submitted 2012) for developing a sensor to perform real-time measurements in the field. This sensor applies the laser spark plug technology that was developed at NETL by Dustin McIntyre and Steven Woodruff and was featured in the article "Laser Car Ignition Dream Sparks Multiple Approaches," by Laura Marshall in the September issue of ***Photonic Spectra***. In the remote sensing application, the system would allow for a centrally located computer/controller (shown to the right) to connect to multiple sensor locations instead of deploying many LIBS analysis systems to multiple locations. This development will allow NETL researchers to apply the LIBS technique in a number of carbon sequestration and Marcellus Shale research projects such as carbon dioxide (CO_2) leak monitoring, seal integrity, CO_2-rock interaction, and Marcellus shale gas and water monitoring.



Optically distributed LIBS sensor network

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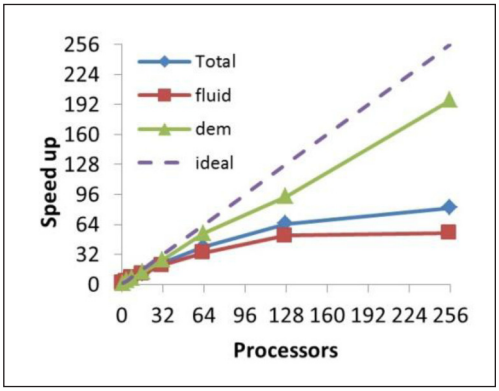
Technology Spotlight

Accelerating MFIX

NETL-RUA Principal Investigator Danesh Tafti and his team at Virginia Tech are working towards using the latest computing technology for accelerating NETL's Multiphase Flow with Interphase eXchanges (MFIX) open source software. MFIX is general purpose software developed for modeling multiphase flows that occur in coal and biomass gasifiers and other solid- fluid systems of relevance to many processes in the energy and power generation sector. By using MFIX as an analysis tool, large potential cost savings can be realized in scaling systems from the lab to the industrial scale. Researchers are investigating the mapping of MFIX to multi- and many-core parallel architectures, where thousands of cores can work on the solution simultaneously to speed up time to solution. The figure to the right shows the speed gained when a shallow fluidized bed is simulated with MFIX-DEM using 32, 64, 128 and 256 processors (solid blue line). These developments will allow larger systems to be simulated with much higher fidelity than is currently possible.



Scaling analysis of a shallow bed simulated with MFIX-DEM

For computational fluid dynamics (CFD) codes such as MFIX, code verification ensures that the CFD software is an accurate representation of the underlying differential equations, which in this case are the Navier-Stokes equations for multiphase flow. Professor Christopher Roy and his team at Virginia Tech are performing code verification of MFIX through the use of order-of-accuracy testing to ensure that there are no mistakes in the computer code or inconsistencies in the numerical algorithm.

Due to the complexity of the Navier-Stokes equations, it can be difficult to obtain exact solutions that are general and exercise all terms in the equations. To avoid this difficulty, the team employs the method of manufactured solutions, which produces exact solutions for differential equations of almost arbitrary complexity by adding artificial source terms to the governing equations.

A second challenge is that the solutions produced by the CFD code do not exactly coincide with the exact solutions to the differential equations due to numerical errors associated with the flow field grid, the finite time step, computer round off, and iteration errors. The presence of these numerical errors is addressed by examining the limiting behavior of the CFD solutions as these numerical errors are driven to be small (e.g., as more grid cells are added and as the time step is reduced).

The order-of-accuracy verification procedure applied to MFIX for steady state, fully-developed laminar channel flow reduces to a second-order rate as the mesh is refined, thus confirming the correctness of the laminar flow equations within MFIX along with three different boundary conditions (inflow, outflow, and solid wall). Future tests will explore the use of manufactured solutions and examine multiphase flow models within MFIX. Both Professor Tafti and Professor Roy presented their work at the 2012 NETL Multiphase Conference, which took place on May 22-24, 2012, https://mfix.netl.doe.gov/workshop/index.php). The articles will also appear in a special issue of ***Powder Technology Journal***, which is devoted to the 2012 NETL Multiphase Conference.

Upcoming Events

- **2012 AIChE Annual Meeting, Cleaner Energy, Stronger Economy, Better Living**, October 28–November 2, 2012 | David L. Lawrence Convention Center | Pittsburgh, PA
- **NETL-RUA 2012 Fall Conference: 2nd Annual Energy & Innovation Conference**, November 28–29, 2012 | Southpointe Hilton Garden Inn | Canonsburg, PA *(see lead article on page 1)*