

## Falling in Love with Corrosion: Ziomek-Moroz Wins Technical Achievement Award

**Margaret Ziomek-Moroz** is so passionate about corrosion that she can find beauty in cracked concrete, but while pursuing her master's in chemistry (with a concentration in electrochemistry) at the University of Warsaw, she never considered specializing in the field. Luckily, the Institute of Physical Chemistry of the Polish Academy of Sciences was seeking someone with an electrochemistry background to pursue PhD status and selected her. While there, she fell in love with corrosion science and engineering. Corrosion is dangerous, she explains, "because corrosion damage can lead to catastrophic failures." Corrosion cracks in cooling-water systems can sabotage a nuclear power plant. Rusty rebar in concrete beams can bring down a bridge.



Ziomek-Moroz accepts NACE International's 2013 Technical Achievement Award for her work in corrosion science and engineering.

Ziomek-Moroz, now a research chemist at the National Energy Technology Laboratory (NETL), lets her interest in corrosion drive her research. Her work earned her the 2013 Technical Achievement Award from NACE International, the primary professional organization for the corrosion control industry. The award honors technical achievements that significantly benefit corrosion control practices or the corrosion engineering profession.

Ziomek-Moroz has used coatings that prevent bridges from corroding and developed environmentally friendly electrolytes for electrochemical machining of brittle alloys. She has also explored ways to reduce the cost of solid oxide fuel cells—a green and efficient (but pricey)

>> See AWARD, Page 2

### What's in This Issue

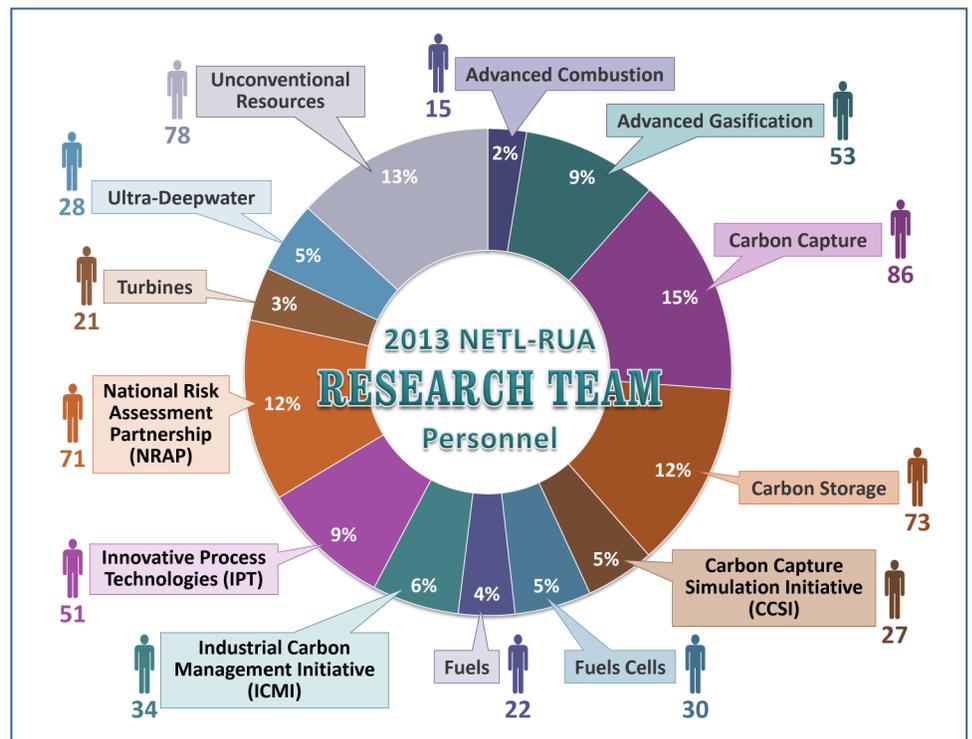
- 3rd Annual Energy and Innovation Conference to Be Held September 17 .....p. 2
- NETL-RUA Synergies Create Material Promise for CO<sub>2</sub> Capture .....p. 3
- NETL Seeks to Patent Compact, Portable Sensor Technology .....p. 4
- Gas-to-Market & Energy Conversion Forum to be Held October 8–11 .....p. 4

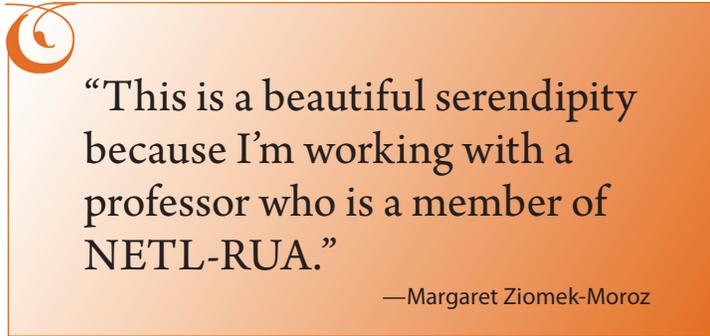
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>> **AWARD**, Continued from Page 1

energy source—by investigating the corrosion resistance of metallic materials, which are relatively inexpensive fuel-cell components.

Ziomek-Moroz has been collaborating with **Serguei Lvov** of the Pennsylvania State University (Penn State) on studying alloy corrosion behaviors in severe environments since 2010. She calls her collaboration with Lvov “wonderful and extremely productive.” When Penn State joined the NETL-Regional University Alliance (NETL-RUA), she thought, “This is a beautiful serendipity because I’m working with a professor who is a member of NETL-RUA.” Next year, the two plan to develop sensors that monitor corrosion in oil and gas components. “My brain is in oil and gas right now,” she says. It seems, however, that her heart will always be in corrosion science and engineering.

## Did You Know?

The Members Only SharePoint Site (MOSS) has undergone several changes over the past few months in an effort to enhance its usability. MOSS serves as both an information portal and workspace for research teams and ad hoc committees to share documents and collaborate and is available to all NETL-RUA members.

**NEW!** Functionality giving researchers the ability to collaborate with others regarding new opportunities has been added to the site. Check out the Solicitation – Opportunity Announcements Section (button) and begin collaborating with other investigators who share the same interests! To request a MOSS account for yourself or a team member, please send a request to [NETL-RUA-FB@netl.doe.gov](mailto:NETL-RUA-FB@netl.doe.gov).

## CORRECTION

The article, *Two NETL-RUA Inventions Win the “Oscars of Innovation,”* in the August edition of the NETL-RUA E-NEWS misstated the name of the company that supported NETL’s Arc Position Sensing research. The correct company is ATI-Albany Operations.

## 3rd Annual Energy and Innovation Conference to Be Held September 17



The NETL-RUA and Catalyst Connection have teamed up to host the 3rd Annual Energy and Innovation Conference on September 17, 2013. Attendees from a wide variety of backgrounds—from business, to finance, to academia—will meet at the Hilton Garden Inn Pittsburgh/Southpointe in Canonsburg, PA, to forge partnerships, discuss bringing technologies to market, and gain new perspectives on commercializing innovations.

The keynote address by Christopher Miller, CEO and founder of Innovation Focus, will dispel myths surrounding innovation, introduce skills that make innovation possible, and describe how companies can produce what Miller calls “game changers.”

The attendees will not only learn about game changers by listening to Miller’s presentation, they will also get to predict the next NETL game changing research innovation. Emerging technologies in the running include novel sensors, catalysts, sorbents, materials for gas separation, a treatment for oxidation resistance, and an improved laser-induced breakdown spectroscopy method for detecting chemical compositions. An expert panel will weigh in on the technologies as well.

The topics at the conference will go beyond game changers. Speakers will also discuss the “Valley of Death”—or the period of development when an influx of investment is needed and a project appears increasingly risky. Additionally, representatives from the energy and environmental sectors will reveal the challenges they face, the opportunities they hope to capitalize on, and strategies corporations use to nurture innovation. The representatives will share success stories and explain the benefits of enlisting outside help to support product development. The conference will conclude with a poster showcase and reception that offers attendees networking opportunities.

**You only have a few days left to register. Visit the [website](#) for more information.**

## Technology Spotlight



### NETL-RUA Synergies Create Material Promise for CO<sub>2</sub> Capture

A critical aspect of greenhouse gas mitigation is capture of carbon dioxide (CO<sub>2</sub>) from stationary point sources, including power plants. Several carbon capture approaches are currently under development, including those based on solvents, sorbents, and membranes. NETL-RUA's Mixed Matrix Membrane (MMM) team combines expertise and research in all three areas to work towards meeting the U.S. Department of Energy's goal of achieving a capture cost of less than \$40 per tonne of CO<sub>2</sub> (assuming 90 percent capture).

The MMM team is developing composite membranes consisting of metal organic framework (MOF) filler particles in a polymer matrix. MOFs have a spectacular ability to be tailored for specific properties, including gas separations, but it is difficult to make a membrane out of these crystalline materials. Unless a single-crystal membrane (too difficult to manufacture, and therefore too expensive) is used, gas transport will occur at the boundaries where the crystal grains meet rather than through the grains.

Polymer membranes are also highly tunable and are comparatively cheap to manufacture. But in a pure polymer membrane, a tradeoff exists between permeability and selectivity. According to NETL's **Dave Luebke**, if a polymer matrix can be used to support MOF filler particles, then one has the best of both materials. But the catch is that MOFs don't play well with polymers; they get encapsulated in bubbles and the gas flows around the filler particles instead of through them.

Most researchers who have attacked the CO<sub>2</sub> separation problem, continues Luebke, specialize in either membranes or polymers or MOFs. The NETL-RUA MMM team comprises researchers in all three specialties. Key members include **Hunaid Nulwala** (Carnegie Mellon University); **Nathaniel Rosi** (University of Pittsburgh); **Surendar Venna** (West Virginia University); **Erik Albenze** (URS); NETL intern **Michael Lartey** (Oak Ridge Institute for Science and Education); and Luebke. Working together, this team has achieved results that have eluded others.

The team completed preliminary testing of first-generation membranes earlier this year with promising results, meeting the CO<sub>2</sub>/nitrogen selectivity minimum target and proving the success of the approach for incorporating MOF filler particles into the polymer matrix. Though these early MMMs fell short of the target for gas permeance through the membrane, the next generation of MMMs is currently in development. A second big achievement, according to Albenze, was completion of the upgraded high-throughput testing unit, which now permits operation at elevated temperatures.

According to Albenze, the MMM project is particularly interesting because membrane research to solve this issue has been ongoing for much of the past decade but is still at a stage where new discoveries can lead to big increases in performance. Since this energy research is still considered to be in its infancy, any development has the potential not only to improve the technology which already exists, but also to be part of the solution to the carbon capture problem.



*The light blue crystalline structures are a metal organic framework (MOF).*

#### Upcoming Events

- The [3rd Annual Energy & Innovation Conference](#) will take place on September 17, 2013, at the Hilton Garden Inn, Southpointe, in Canonsburg, PA.
- [2013 University Turbine Systems Research \(UTSR\) Workshop](#)  
October 8-10, 2013  
Purdue University, West Lafayette, Indiana

#### Grid Technologies Collaborative National Conference Materials Available

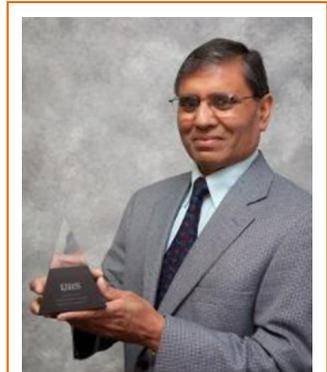
The Grid Technologies Collaborative (GTC) held its first conference on grid-scale power electronics on June 10, 2013, in Arlington, Virginia. More than 70 students, researchers, and representatives from the energy industry and government were in attendance. Conference presentations, attendees, and the 2012 GTC Research and Development Report can be found on the NETL-RUA website [here](#).

## Noteworthy Achievements

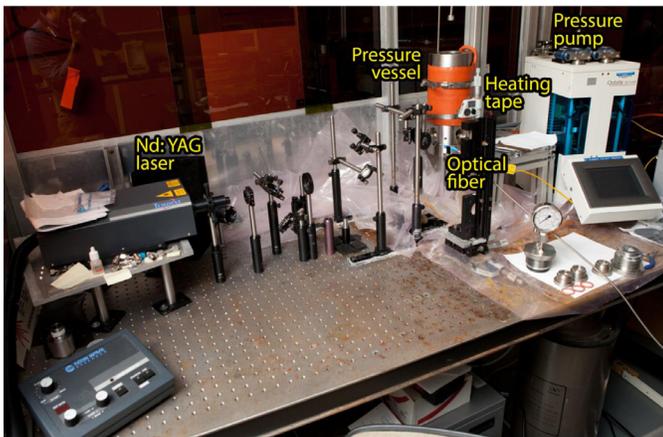
### NETL Seeks to Patent Compact, Portable Sensor Technology

An NETL-RUA team of researchers continued their study of laser-induced breakdown spectroscopy (LIBS) technology. The team developed a LIBS-based optical sensor for CO<sub>2</sub> leak monitoring and carbon sequestration research. The LIBS sensor employs a low peak power pumping pulse delivered by optical fiber to a laser, the output of which can be used for field, underground, or underwater monitoring of carbon dioxide leaks. According to **Drs. Jinesh Jain** (URS) and **Dustin McIntyre** (NETL) the availability of double-

pulsed laser systems and miniaturization components creates the potential to provide a compact, portable system for carbon sequestration field applications and Marcellus Shale research. Jain, McIntyre, and their NETL colleague **Steve Woodruff** submitted the patent application, "A method and device for remotely monitoring an area using a low peak power optical pump," for this technology.



Jain was a recipient of the URS Pyramid Award of Excellence



LIBS instrumentation currently used at NETL for measurement within a pressure vessel.

In recognition of his collaboration on the LIBS research, Dr. Jain was recently presented with the URS Pyramid Award of Excellence, which recognizes the highest-performing URS employees who exemplify outstanding achievement and foster a positive work environment. Nearly 500 URS projects worldwide were nominated for the Award of Excellence but only 108 of them were recognized with the award. For Dr. Jain, the Pyramid Award of Excellence was an accomplishment that had been on his "wish list" since URS implemented the awards program. "It is exciting to receive this award for the LIBS work we are doing at NETL," he said.

### Gas-to-Market & Energy Conversion Forum to be Held October 8–11

Energy Frontiers International (EFI) will hold its Gas-to-Market and Energy Conversion Forum October 8–11, 2013, in San Francisco, California. EFI's annual member forum focuses on exploring the status and outlook for a wide range of technologies being employed worldwide to bring natural gas to market, with an additional focus on other forms of energy conversion.

This forum will bring together stakeholders involved in key developments in several areas related to technologies, strategies, and projects. These areas include the utilization of natural gas and production of syngas from any feedstock and its conversion to fuels and chemicals. This year's keynote presentations include sessions focusing on small-scale and modular gas-to-liquids (GTL), GTL in North America, technology developments for small-scale syngas generation, global gas flare reduction, and perspectives on the emerging markets for natural gas.

This year's Gas-to-Market and Energy Conversion Forum will include an industry roundtable with NETL-RUA researcher **Bryan Morreale**, acting Materials Science and Engineering Focus Area Lead and acting director of the Thermal Science Division within the Office of Research and Development. For more information on the conference, visit [EFI's website](#).

All issues of E News can be found on MOSS and the [NETL-RUA website](#).

If you have information that you would like to feature in future newsletters, send that information to [NETL-RUA-FB@netl.doe.gov](mailto:NETL-RUA-FB@netl.doe.gov).

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