ORNL wins 9 R&D 100s, bringing total to 173

Researchers at the Department of Energy's Oak Ridge National Laboratory have received nine R&D 100 awards. The awards, presented by R&D Magazine, recognize the top 100 innovations of 2012 and are sometimes referred to as the "Academy Awards of Science."

"Congratulations to this year's R&D 100 award winners," said Energy Secretary Steven Chu. "The research and development at the Department of Energy's laboratories continues to help the nation meet our energy challenges, strengthen our national security and improve our economic competitiveness."

The nine awards bring ORNL's total of R&D 100 awards to 173. ORNL researchers and engineers received awards for the following technologies:

Nano-Super Hard – Inexpensive – Laser Deposited Coatings, or NanoSHIELD Coatings, were developed by ORNL in conjunction with Lawrence Livermore National Laboratory, Strategic Analysis Inc., Ozdemir Engineering Inc., Colorado School of Mines and Carpenter Technology Corp. ORNL's team consisted of William Peter, Ryan Dehoff, Peter Blau, Craig Blue, Thomas King Jr., Art Clemons, John Rivard, Wei Chen, Andrew Klarner, Kevin Harper and Larry Lowe.

NanoSHIELD is a protective coating that can extend the life of costly cutting and boring tools by more than 20 percent, potentially saving millions of dollars over the course of a project. It is created by laser fusing a unique iron-based powder to any type of steel, which forms a strong metallurgical bond that provides wear resistance between two and 10 times greater than conventional coatings. NanoSHIELD was designed to protect high-wear tools used for tunnel boring and construction, but its potential for Navy applications and geothermal drilling tools also is being explored.

The project was funded by the Defense Advanced Research Project Agency, DOE's Loan Programs Office, the Office of Civilian Radioactive Waste Management, and Office of Energy Efficiency and Renewable Energy.

RCSim (Radio Channel Simulator) Software was jointly developed and submitted by ORNL and Networcsim LLC. The ORNL developers were Phani Teja Kuruganti and James Nutaro.

RCSim Software provides the information needed to offer wireless networks to challenging areas such as factory floors, underground mines and offshore drilling platforms. RCSim predicts radio signal strength with greater accuracy than competitors throughout geometrically complex environments such as industrial facilities and dense urban areas. This inexpensive device uses an algorithm that quickly calculates the time delay and power of every radio signal delivered to a particular site. The information gleaned from RCSim can affect the design of wireless networks for environments that are currently unable to take advantage of the wireless revolution.

The project was funded by the ORNL Laboratory Directed Research and Development program.

HiCap Adsorbents were jointly developed and submitted by ORNL and Hills Inc. The ORNL team consisted of Christopher Janke, Yatsandra Oyola, Chris Bauer, Xiao-Guang Sun, Costas Tsouris, Sheng Dai, Richard Mayes and Tomonori Saito.

Recent advancement in surface area modification has allowed HiCap Adsorbents, low-cost reusable materials, to selectively remove metals from aqueous environments. For example, HiCap's uptake of uranium is nearly seven times more than that of any similar product. The selective sorption capacity of heavy metals by HiCap can be used for potential nuclear energy and environmental applications.

The project was funded by DOE's Office of Nuclear Energy.

Low-Cost, Lightweight Robotic Hand Based on Additive Manufacturing was developed and submitted by Lonnie Love, Bradley Richardson, Randall Lind, Ryan Dehoff, William Peter, Larry Lowe, Craig Blue, Martin Keller and Art Clemons.

The Robotic Hand costs approximately 10 times less than similar devices while commanding 10 times more power than other electric systems. Composed of only 46 parts, this simplified lightweight robotic hand can be manufactured and assembled within 40 hours, and its size can be adjusted based on need. The robotic hand is created with additive manufacturing and uses fluid power. It has its greatest impacts in robotics, prosthetics, remote handling and biomedical and surgical applications.

The project was funded by internal laboratory R&D funds, DOE's Office of Energy Efficiency and Renewable Energy and the Defense Advanced Research Project Agency.

Asymmetric Rolling Mill: A Novel Route for Processing Sheet and Plate was jointly developed and submitted by FATA Hunter Inc., ORNL and Magnesium Elektron North America. The ORNL team consisted of Govindarajan Muralidharan, Thomas Muth, Evan Ohriner, William Peter, David Harper, Thomas Watkins, Eliot Specht and Alan Liby.

The Asymmetric Rolling Mill provides a way to efficiently process sheet and plate materials, accelerating the production and availability of low-cost magnesium. Magnesium is a lightweight metal that has practical applications in goods such as personal electronics and automobile production. Commercial use of magnesium has been limited because of the high cost associated with its multistep production process. This technology is likely to reduce processing steps, thereby reducing the cost of finished magnesium components and allowing for the replacement of aluminum with magnesium in many commercial goods. The widespread use of magnesium instead of aluminum in cars would reduce vehicle weight and lead to improvements in transportation by improving fuel economy.

Funding was provided by DOE's Office of Energy Efficiency Renewable Energy with cost sharing from Magnesium Elektron North America.

Low-Cost Plasma Processing System for Research and Pilot Production, or LFRF-501, was jointly developed and submitted by Structured Materials Industries, ORNL and the University of California at Santa Cruz. ORNL's participants were Govindarajan Muralidharan, Parans Paranthaman, Tolga Aytug, Fred List and Harry Meyer III.

Structured Materials Industries collaborated with ORNL and the University of California at Santa Cruz to develop LFRF-501, a low-cost plasma generator for research, development and production of nanometer scale materials. Many new materials are being developed in the form of nanometer scale structures such as thin films, nanowires and nanocomposites. These materials are enabling new developments in many technologies, including microelectronics, renewable energy, sensors, LEDs and others. The LFRF-501 enables production of nanoscale materials at lower temperatures, faster rates and with enhanced properties.

The research was funded by DOE's Office of Energy Efficiency and Renewable Energy, and Office of Electricity Delivery and Energy Reliability.

Broadband Micromechanical Antenna was developed by ORNL's Panos Datskos, Nickolay Lavrik, Dayrl Briggs and Slobodan Rajic.

The Broadband Micromechanical Antenna is a small electronic device that can replace traditional long metal antennas. It represents a potentially revolutionary system that detects very small electric fields over large frequency ranges while maintaining substantial power efficiency. The antenna's size and wider frequency range results from the use of nanomechanical oscillators that are tuned to specific electromagnetic waves. The technology can affect magnetic field sensing, remote sensing applications, lightning detection and underground and underwater telecommunication.

The project was funded by ORNL's Laboratory Directed Research and Development program.

Wavelength-shifting scintillator neutron detector, or WLS detector, was jointly developed and submitted by ORNL and PartTec Ltd. ORNL's team consisted of Lloyd Clonts, Ronald Cooper, Lowell Crow, Yacouba Diawara, Bruce Hannan, Jason Hodges, Richard Riedel and Cai-Lin Wang.

The WLS detector is a breakthrough technology for replacing large area helium-3 detectors at neutron scattering facilities throughout the world. The WLS detector performs many of the same functions as the helium-3 detectors; however, the WLS detector uses lithium-6 instead of helium-3 gas to detect neutron radiation. This replacement technology is critical because there is a long-term shortage of helium-3 gas — a material that is required for the operation of the helium-3 detectors. Neutron detectors are used in medical physics, nondestructive testing, advanced neutron imaging science, environmental monitoring and for homeland security. The

WLS detector is the only large-area solid-state neutron detector in the world and is commercially available in the United States.

The project was funded by DOE's Office of Science.

Highest Pinning Force, High-Temperature Superconducting Wires with Double-Perovskite Tantalate Nano-Pinning Centers was jointly developed and submitted by ORNL and SuperPower Inc., a subsidiary of Furakawa Electric Company, Japan, and the University of Houston. The ORNL team consisted of Amit Goyal, Sung-hun Wee, Claudia Cantoni and Eliot Specht.

This technology allows high-temperature superconducting wires to carry more current in high, applied magnetic fields. This is accomplished by incorporating controlled nanostructures of a new phase within the superconducting wire.

The project was funded by DOE's Office of Electricity Delivery and Energy Reliability.

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