# ORNL inventions win three 'Research and Development 100s'

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***Highly Selective, Regenerable Perchlorate Treatment System, Advanced Heating System for High-Performance Aluminum Forgings and SniffEx are the three inventions receiving Research and Development 100 awards this year***

Researchers and engineers at the Department of Energy's Oak Ridge National Laboratory have won three Research and Development 100 Awards, pushing their national lab-leading total to 119 since the awards began in 1963.
The awards are presented annually by Research and Development Magazine in recognition of the year's most significant technological innovations. ORNL's total places it first among DOE laboratories and second only to General Electric.

The honors were for the following inventions:

**Highly Selective, Regenerable Perchlorate Treatment System**, developed by Baohua Gu, Gilbert Brown, Bruce A. Moyer, and Peter V. Bonnesen of ORNL.

The Highly Selective, Regenerable Perchlorate Treatment system uses a unique, highly specific resin to trap the perchlorate, or ClO4, destroy it, and regenerate itself so it can be reused. Perchlorate, the primary ingredient of solid rocket propellant, is increasingly being discovered in soil and water. The chemical disrupts function of the human thyroid gland, which regulates metabolism in adults and physical development in

children.

The system created by ORNL uses a process known as selective ion exchange, which is the preferred treatment technology for removing contaminants such as perchlorate from water. However, the resins often absorb chemicals other than those targeted for cleanup. They also become contaminated and must be disposed of, destroyed or stored, which is costly and often impractical.

The reaction in the ORNL treatment system that destroys the perchlorate also produces a chemical that regenerates the resin, breaking the perchlorate down into harmless chloride and water. The result is an 80 percent reduction in costs over other ion exchange procedures and elimination of the problem of secondary waste.

**Advanced Heating System for High-Performance Aluminum Forgings**, developed by Craig Blue, Puja Kadolkar, Peter Engleman, Charles Howell, Jackie Mayotte, Vinod Sikka and Evan Ohriner of ORNL; Robert Kervick of Komtek of Worcester, Mass.; Howard Mayer of Queen City Forging Company of Cincinnati; George Mochnal of Forging Industry Association of Cleveland; Teiichi Ando and Hui Lu of Boston's Northeastern University; and Charles Blue of Infrared Heating Technologies of Oak Ridge The Advanced Heating System uses an optimized combination of radiant and convection heating for processing materials. When used to heat aluminum billets, the system reduces heating time and energy consumption and produces high-performance forgings with significantly improved tensile and fatigue properties, compared to those heated by conventional techniques.

High-performance aluminum forged components are lightweight and can serve as a less costly substitute for titanium and other expensive components in automotive and aerospace applications. The Advanced Heating System also offers potential applications in other thermal

processes, including joining and heat treatment, and can be tailored to process additional materials such as steel, titanium and nickel-based alloys.

**SniffEx**, developed by Thomas Thundat, Lal Pinnaduwage, Tony Gehl, Vassil Boiadjiev and Eric Hawk of ORNL; David Hedden of the University of Tennessee; Eric Houser of the Naval Research Laboratory; Linda Deel of the Bureau of Alcohol, Tobacco, Firearms, and Explosives; and Richard Lareau of the Transportation Security Administration

SniffEx is a compact, low-cost explosive vapor sensor for detecting and locating a variety of explosives, including plastic-based explosives. A micromechanical transducer, no wider than a human hair and with a mass of only a few nanograms, allows only explosive molecules to chemically adsorb to a sensor that can identify the molecule. SniffEx is an improvement over other explosive detection products (such as gas chromatography/mass spectrometry and gas chromatography/surface acoustic wave devices) because of its sub-part-per-trillion sensitivity and high selectivity, direct vapor sensing, low power consumption (the instrument uses a 9-volt battery), less than one-second response time, stability, compact size, and low cost. SniffEx will have applications in counterterrorism, law enforcement, airport safety and humanitarian efforts such as landmine removal.

ORNL is managed by UT-Battelle for the Department of Energy.

Source: Oak Ridge National Laboratory