SRNL™
Savannah River National Laboratory
factsheets

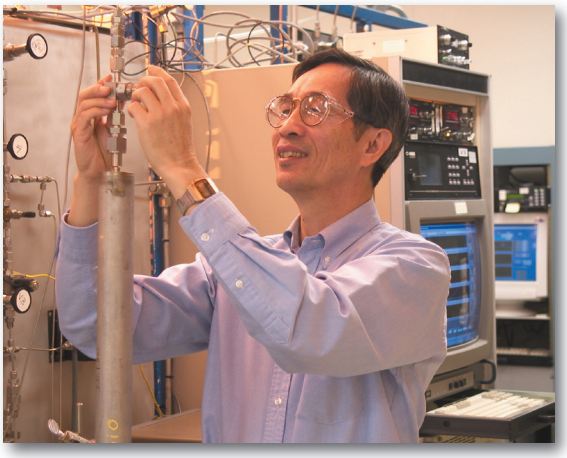
CORE COMPETENCY

Hydrogen and Tritium Science & Technology

Overview and History

Savannah River National Laboratory has over 50 years of experience in developing and deploying technologies for safely and efficiently working with hydrogen. This expertise is grounded in five decades of technology support for the Savannah River Site's (SRS) work with tritium, the radioactive isotope of hydrogen that is a vital component of modern nuclear defense. SRS began producing tritium to support the national defense in 1955, and today is the nation's only center for recycling and purifying tritium. SRS will also be central to the nation's process for producing new tritium, which is scheduled to become operational in FY07. SRNL plays an integral role in these programs by developing, enhancing, and working with SRS Operations to deploy the needed technologies.

SRNL's leading-edge hydrogen research and development not only sustains national security, but also supports President Bush's Hydrogen Fuel Initiative to ensure our nation's long-term energy security and a clean environment. Using hydrogen to fuel our economy can reduce dependence on imported petroleum, diversify energy resources, and reduce pollution and greenhouse gas emissions.



Dr. Leung (Kit) Heung has over 20 years of experience in the development of hydrogen processing technology and holds 13 patents. His research interests include hydrogen storage and isotope separation technologies.

Hydrogen Expertise

SRNL has the largest collection of hydrogen experts in the country, with more than 80 scientists and engineers dedicated to hydrogen and tritium missions. SRNL expertise ranges from molecular and process modeling to the development of new materials and techniques for separating and storing hydrogen safely and efficiently.

Hydrogen Production

Hydrogen is plentiful across our planet, but it is bound in water or other compounds. Breaking apart those compounds to release the hydrogen requires energy, so the quest is to find the cleanest, most energy-efficient method possible to do this. SRNL expertise is being focused on a number of initiatives to support our nation's hydrogen program, including:

- Leading a team of industrial and academic partners to evaluate the technical and economic issues associated with using the heat from an advanced nuclear reactor or a solar furnace to "crack" water into hydrogen and oxygen.
- Participating in a team studying algae that produce hydrogen when exposed to sunlight.
- Developing thermochemical cycles for use with an advanced nuclear reactor or other high-temperature heat source to produce hydrogen directly from water.

SRNL is a national leader in developing metal hydride materials for hydrogen storage. Shown is lanthanum nickel aluminum alloy.

Hydrogen Storage

Safe, efficient hydrogen storage is equally important for defense and for transportation applications. How to store hydrogen on-board a vehicle is one of the key technological challenges that must be addressed to make future hydrogen-powered vehicles practical for the American consumer. SRNL focuses its research on solid-state hydrogen storage because it is safe, and at the same time more compact and convenient than storage as a gas or liquid.

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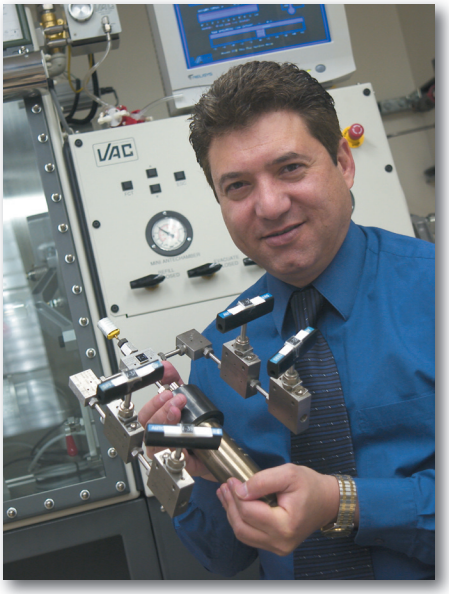
Hydrogen and Tritium Science & Technology



Dr. Ragaiy Zidan has conducted internationally recognized research on materials for hydrogen storage. His current focus is hydrogen storage research and development involving novel materials such as alanates, doped carbon nanotubes, and both amorphous and conventional metal hydrides.

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SRNL is a leader in the development and application of technologies that use metal hydrides – materials which reversibly absorb and release hydrogen like a sponge. SRNL has developed and patented several devices using hydride for storing hydrogen. The hydrides developed for tritium use, however, are too heavy to be practical for automotive applications. Current storage research is studying the potential for:

- A new generation of lighter-weight, complex metal hydrides
- Metal-doped carbon nanotubes - long, thin structures (approximately 1/10,000 the width of a human hair) that show great potential because they may be able to bond with large amounts of hydrogen at room temperature.
- Hollow glass microspheres - microscopic glass "beads" with porous walls, which can be filled with hydrogen storage material.

SRNL is supporting the American Society of Mechanical Engineers Code Committee on Hydrogen Storage Tanks to help provide the needed changes to the pressure vessel code for safe hydrogen storage.

Separation

SRNL has extensive experience in hydrogen separation technology based on its ongoing defense work, and continues to develop new and more efficient processes. SRNL has developed a patented technology for separating hydrogen from other gases, particularly carbon monoxide and other hydrocarbon combustion products.

Collaborations

By working together with other laboratories, universities, industry and governmetal entities, SRNL is working to advance both hydrogen technology and its economic benefits.

- SRNL is working with automakers, including Toyota and GM, on technologies to make hydrogen vehicles practical for the American consumer
- The laboratory is working with South Carolina's research universities, as well as academic institutions across the nation, on hydrogen-related projects.
- SRNL is a founding member of the South Carolina H2 and Fuel Cell Alliance, a not-for-profit organization that represents the interests of South Carolina industry, academia, and research organizations involved in the new hydrogen economy.
- Aiken County has constructed the Center for Hydrogen Research at the Savannah River Research Campus, adjacent to SRNL. SRNL's unclassified hydrogen research will occupy half of this state-of-the-art hydrogen research facility, while the other half will be occupied by universities and industry engaged in related research. This arrangement will foster collaborative efforts.

Facilities

In addition to the laboratories at the new Center for Hydrogen Research, SRNL has a variety of facilities to support hydrogen research, including:

- Engineering development laboratory
- Heat transfer laboratory
- Bench- and pilot-scale hydrogen storage and delivery systems
- Failure analyses and materials testing laboratories
- Analytical laboratories

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