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factsheets

SRNL and Hydrogen Research:

A Natural Connection

Why is Savannah River National Laboratory conducting hydrogen research and development?

SRNL's hydrogen research and development work is a continuation of work that the Laboratory has been doing for over 50 years. Since the 1950s, SRNL has been providing the technology support that has enabled the Department of Energy's Savannah River Site to maintain the nation's supply of tritium, a radioactive isotope of hydrogen that is vital to our national defense.

This long-term research and development in support of the tritium mission led to the development of vital hydrogen expertise, including hydrogen storage, purification, and separation, in addition to critical skills in the analytical detection of hydrogen isotopes, and the effects of hydrogen on containment and storage materials.

The unique skills and expertise that SRNL applies to the nation's defense work are applicable to today's quest to make hydrogen energy practical for America's vehicles, homes and industry.

For example, in pursuing its tritium work, SRNL developed several technologies using metal hydrides for safe, stable, solid-state storage of hydrogen and its isotopes. That experience is directly relevant to current hydrogen energy technology needs: Developing a safe, stable, practical storage medium for use on-board a vehicle is one of the key challenges in developing hydrogen-powered vehicles for the American consumer.

Dr. Ragaiy Zidan's (right) research in metal hydrides and complex alanates is leading to new achievements in hydrogen storage.

How does the Department of Energy benefit from SRNL's hydrogen research?

Both the Department of Energy's hydrogen energy programs and the National Nuclear Security Administration's Defense Programs benefit from SRNL's achievements in hydrogen reserach and development.

- SRNL's work in hydrogen storage, production, separations and related topics advances DOE's support of the President's Hydrogen Fuel Initiative. The Laboratory is applying its 50 years of hydrogen experience to addressing some of the biggest technological challenges of the hydrogen economy.
- SRNL continues its research and development work that specifically supports NNSA's Defense Programs tritium mission.
- Due to the cumulative nature of research, NNSA also benefits from SRNL's energy-related research. Each advance in hydrogen R&D has the potential to be relevant to tritium work as well.
  - As an example, the insights SRNL gained while developing one of the nation's first hydrogen-powered passenger buses in the 1990s allowed the laboratory to significantly reduce the size and cost of the Savannah River Site's next generation of hydrogen isotope separation facilities, while increasing safety and environmental protection.

FAST FACTS

- SRNL has been a world leader in hydrogen research and development for over half a century.

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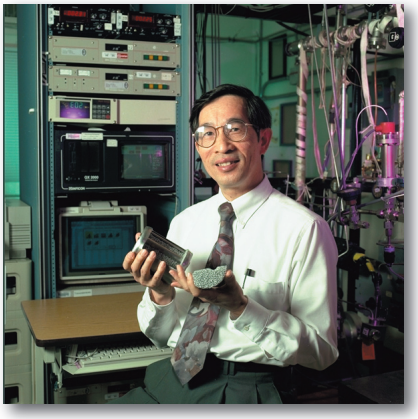

Dr. Kit Heung has developed innovative technologies for the storage and separation of hydrogen, including the design of hydrogen storage beds for transportation and other industrial applications.

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What areas of hydrogen research is SRNL pursuing?

SRNL is focusing its hydrogen research on those areas where its unique experience, built over its 50-plus-year history, gives the Laboratory clear and distinct strengths that would be useful in the nation's pursuit of a hydrogen economy.

These include primarily:

- Hydrogen storage
- Hydrogen separation
- Hydrogen production
- Materials for hydrogen use

Hydrogen Projects

In recent years, SRNL's hydrogen expertise has resulted in several successful hydrogen projects:

- Thermal Cycling Absorption Process (TCAP) for Savannah River Site Tritium Facilities: The new SRS Tritium Facilities, which started up in 1991 to replace 35-year-old facilities, are significantly safer and more cost-effective, as a result of SRNL technologies. SRNL metal hydride technology allows the tritium to be stored, pumped, separated and purified while in a stable, easily-handled, compact solid form. The SRNL-developed TCAP replaced traditional thermal diffusion columns and cryogenic isotope separation processes previously used in trituim extraction. The result is improved operating efficiency, with a greatly reduced facility size.
- Hydrogen Bus: SRNL and a team of partners developed the world's first hydrogen hybrid electric passenger bus, which operated as part of Augusta, Georgia's public transportation fleet in 1997 and 1998. SRNL developed the vehicle's hydrogen storage system, which included the world's largest mobile metal hydride storage bed.
- Hydrogen storage device: Insights gained while working on the hydrogen bus led to SRNL's development of a new hydrogen storage device that is adaptable to various locations. The high performance tubular design of this device permits compact storage, as well as rapid refueling.
- "Gator" Utility Vehicle: Based on the success of the hydrogen bus, SRNL worked with the John Deere Company and other industrial and academic partners on the development of a hydrogen fuel cell-powered industrial vehicle for use in airports, warehouses, etc. The demonstration, from 1998 to 2001, produced a pair of vehicles that performed as well as a gasoline vehicle (and outperformed battery vehicles), while still producing zero emissions.

The hydrogen fuel-cell powered "Gator" utility vehicle

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