TechBriefs

Savannah River National Laboratory

U.S. DEPARTMENT OF ENERGY • SAVANNAH RIVER SITE • AIKEN • SC srnl.doe.gov

At a glance

- Organic-based superconductors
- Cost-effective materials
- Light-enhanced superconductivity
- Applicable for supercomputers
- U. S. Patent 9,685,600 B2

Contact Information

Partnering Opportunities

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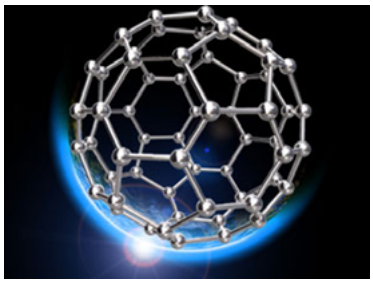
FILMS: Fullerenes Improved with Light Modification for Superconductivity



Savannah River National Laboratory (SRNL) is currently in the proof of concept stage with observed preliminary results on improved performance based on higher purity. SRNL has begun to design experiments to bench-scale tested this method on a prototype.

Potential applications with NASA and DARPA. Other possible applications would be levitation for rail transportation, superconducting coils for magnetization, electric power generators, and magnetic storage.

A patent has been filed with the U. S. Patent and Trademark Office.

Background

The addition of photo-excitation to an existing metal intercalated and/or hydrogenated fullerene has the ability to significantly increase the number of available charge carriers and/or phonons in the conduction band. The change in carrier density and phonon coupling capability may have a multivariate effect including the increase in the critical temperature at a constant field, creating a superconducting hysteresis over a changing magnetic field, decrease in stabilizing magnetic field required for the onset of superconductivity, and increase in the stability of superconductivity for over a larger magnetic field.

The degree of improvement and the optical energy required is dependent on the phase purity of material, degree of lattice mobility with light, and the ability to overcome the thermoelectric barrier in achieving zero resistivity all leading to various changes in onset of superconductivity. We estimate the improvement for the onset of superconductivity to be approximately 10-25 Kelvin higher than without illumination. In the best materials such as Rb3C60 and NaRbCsC60, this increase could produce materials with onset of superconductivity as high as 77 Kelvin (liquid nitrogen).

Additionally, with operation at liquid nitrogen temperatures could also compete with metal oxide superconductors utilized in various applications.

Technology transfer

The Savannah River National Laboratory (SRNL) is the U.S. Department of Energy's (DOE) applied research and development laboratory at the Savannah River Site (SRS).

With its wide spectrum and expertise in areas such as homeland security, hydrogen technology, materials, sensors, and environmental science, SRNL's cutting edge technology delivers high dividends to its customers.

The management and operating contractor for SRS and SRNL is Savannah River Nuclear Solutions, LLC. SRNS is responsible for transferring its technologies to the private sector so that these technologies may have the collateral benefit of enhancing U.S. economic competitiveness.

Stage of development

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Partnering opportunities

SRNS invites interested companies with proven capabilities in this area of expertise to develop commercial applications for this process or product under a cooperative research and development agreement or licensing agreement. Companies interested in licensing will be requested to submit a business plan setting forth company qualifications, strategies, activities, and milestones for commercializing this invention. Qualifications should include past experience at bringing similar products to market, reasonable schedule for product launch, sufficient manufacturing capacity, established distribution networks, and evidence of sufficient financial resources for product development and launch.

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