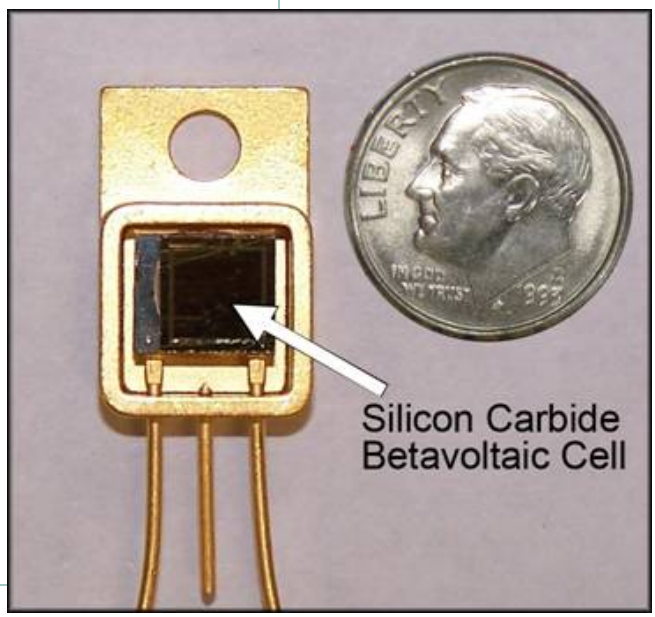
SRNL
SAVANNAH RIVER NATIONAL LABORATORY

techbriefs

High Sensitivity Betavoltaic Radiation Sensors

Researchers at the Savannah River National Laboratory have developed a highly sensitive radiation detection device using a betavoltaic sensor. This device can detect beta emissions when operated under a strong reverse bias. The betavoltaic sensors have been tested in detecting a variety of beta-emitting radioisotopes.



Background

Current techniques for beta detection commonly involve taking smear samples and measuring them by liquid scintillation counting. This approach involves taking samples in the field and testing them with large, maintenance-intensive equipment. The small betavoltaic sensors are more portable and are relatively inexpensive.

Betavoltaic cells are semiconductor devices that operate similarly to photovoltaics. Recent work on betavoltaic cells for battery applications identified silicon carbide (SiC) as an ideal substrate material for increasing the efficiency of the devices. SRNL scientists were able to adapt these SiC cells for beta radiation detection. Sensors based on betavoltaics will be small, portable, require minimal power input, and be maintenance free. In addition, the use of SiC for a detector is advantageous over traditional, silicon-based, solid-state radiation detectors because of its very low leakage current, which can greatly improve the detection limits of the device.

at a glance

- small and portable
- maintenance free
- low leakage current
- improved detection limits
- patent pending

SRNL-L9100-2010-00029

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Advantageous over traditional detectors

Test results showed that the detector output (using Sr-90 and Pu-239 sources) varied proportionally with both the activity of the source and the distance between the source and the detector. The output of the sensor in a forward-baised configuration was on the order of femtoamperes, which can be measured with a high sensitivity electrometer. A small array of betavoltaic cells could be used to provide a stronger output current. Applying a reverse-bias to the sensor would also likely provide a significant improvement in output current.

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.

Partnering opportunities

SRNS invites interested companies and research institutions with proven capabilities in this area of expertise to develop commercial applications for this technology under a cooperative research and development or licensing agreement. Interested companies with an interest 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.

for more information

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