

TechBriefs

Savannah River National Laboratory

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

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Benefits

- > Enhanced mechanical, electrical, optical, and thermal conductivity
- > Easily modified to incorporate various additives for unique functionality
- > Extremely low cost and disposable

Applications

- > Cutting and wear resistant tools
- > Transmission windows
- > Sensing and imaging applications for optoelectronics and semiconductors

Contact Information

Savannah River National Laboratory
Phone: 803.725.8482
E-mail: partnerships@srnl.doe.gov



Method of Manufacturing a 3D Carbon Structure

Background

Savannah River National Laboratory has developed an improved method for manufacturing a three-dimensional carbon structure (i.e. synthetic diamonds with various additives). In particular, SRNL has improved the manufacturing that allows for the control of shape, orientation, and configuration of the final structure. As a result, these structures can be employed in numerous scientific and industrial applications, such as in tools as cutting and wear-resistant materials, transmission windows, sensing and imaging applications for optoelectronics and semiconductors, nuclear applications, as well as in medical implants and drug delivery applications.

Description

Synthetic three-dimensional carbon structures, such as diamonds, have excellent properties and characteristics in comparison to other allotropes of carbon, in part, due to the manner in which the carbon atoms are arranged. These properties include excellent mechanical properties, electrical properties, optical properties, and thermal conductivity, among many other desirable features.

Typical processes for manufacturing these structures require the application of high pressure on graphite, which consists of graphene layers. The force exerted on the graphene sheets can reconfigure their atomic structure into a stable, three-dimensional structure. However, the force necessary can be greater than one hundred thousand times atmospheric pressure, which raises safety concerns. In addition, manufacturing these structures using such processes requires substantial capital and equipment as a result of such safety concerns.

As a result, there is a need for an improved process for manufacturing a three-dimensional carbon structure. In particular, there is a need for an improved process for manufacturing a three-dimensional carbon structure that allows for control of the shape and/or configuration of the final structure.

Intellectual Property

The technology has been submitted for a U.S. Patent SRS-16-010 (October 30, 2017), "Method of Manufacturing a Three dimensional Carbon Structure."



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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 of 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 with proven capabilities in this area of expertise to develop commercial applications for this process under a cooperative research and development agreement (CRADA) or licensing agreement. Interested companies 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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