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DIAMFAB and STMicroelectronics achieve a first in France with long-lasting, tiny nuclear battery

- DIAMFAB, and STMicroelectronics have developed a diamond-tritium nuclear battery with state-of-the-art 10.5% efficiency, delivering power for up to 20 years
- Technology paves the way to long-lasting, ultra-low power sources for use in sensors, space, healthcare, and industrial applications

Grenoble, 25/02/2026– DIAMFAB, a deeptech pioneer in semiconductor diamond technology, together with STMicroelectronics (NYSE: STM), a global semiconductor leader serving customers across the spectrum of electronics applications, today announce a breakthrough in the development of tiny nuclear batteries. After four years of collaborative research and development under the Tbatt-Diamond project, the consortium has successfully designed an innovative diamond-tritium beta-voltaic generator capable of producing continuous electrical energy over several decades.

A tritium-based beta-voltaic generator is a tiny nuclear battery that turns the natural decay of tritium, a radioactive form of hydrogen, into electricity using semiconductor material, similarly to how a solar cell turns light into power. Because tritium decays slowly and its weak radiation is easily blocked, these generators can provide small amounts of power, safely and continuously for many years without recharging or maintenance.

This pioneering technology, combining synthetic diamond and recycled tritium from the nuclear industry, offers a path towards a new generation of compact, chemically inert, and mechanically robust nuclear batteries. These power sources are ideally suited for applications demanding exceptional longevity and reliability, including remote sensors, microsatellites, and autonomous systems operating in harsh environments. This breakthrough unlocks transformative possibilities across diverse sectors such as healthcare, aerospace, industrial monitoring, civil engineering, and defense.

“We have developed unique technological know-how in diamond beta-voltaic cell manufacturing and generator design,” said Gauthier Chicot, CEO of DIAMFAB. *“This collaboration has expanded our understanding and opened pathways to future innovations. We are actively working with ESA and ORANO to create more powerful generators that will offer sovereign solutions for space exploration.”*

"STMicroelectronics is at the forefront of R&D on ultra-low power microcontroller innovation and energy-harvesting technologies. Tbatt-Diamond demonstrates exciting possibilities for long-lasting nuclear micro-batteries that could power autonomous, maintenance-free devices that meet the highest standards of efficiency and reliability for future self-powered IoT and New Space applications,” said Philippe Roche, Company Fellow High Reliability and Head of Technology Explorations and Ecosystems at STMicroelectronics.

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TBATT: a breakthrough in long-life energy generation

The Tbatt-Diamond consortium has demonstrated diamond beta-voltaic cells with a conversion efficiency of 10.5%, achieving an energy density of 15 nW/cm^2 when paired with a Beta source developed by CEA. This represents the first major achievement in France in nuclear battery technology since the MEDTRONIC-ALCATEL effort in the 1970s to power pacemakers with plutonium-based nuclear batteries.

The consortium members brought complementary expertise:

- **DIAMFAB**, project coordinator and diamond semiconductor specialist, led the design, manufacturing, and characterization of the diamond conversion cells central to the generator's performance.
- **STMicroelectronics** designed the advanced ultra-low power control and processing electronics and the energy harvesting systems to optimize the potential integration of this novel energy source into industrial and consumer applications.
- **CEA** contributed its expertise in hydrogen isotope handling, dealing with loading, labelling and stability assessment of materials, especially for radionuclides. Its dedicated facilities constitute a unique scientific resource in Europe.

The consortium's success lies in the unique synergy between synthetic diamond's robustness and superior energy conversion efficiency, stable beta-emission from a light nuclear source. The resulting beta-voltaic generators deliver a constant, high energy density output for over twenty years, without environmental sensitivity or radiological hazards. Beyond powering devices in extreme or inaccessible environments, this technology also potentially contributes to improved radioactive waste utilization by transforming tritium—a common nuclear byproduct—into a valuable energy resource.

The Tbatt-Diamond project was supported by the France 2030 plan and the Future Investments Program (PIA 4), initiatives designed to foster strategic innovation and strengthen France's technological sovereignty. Coordinated by the General Secretariat for Investment (SGPI) and funded by Bpifrance.

Next steps

Looking ahead, the team aims to push conversion efficiency and increase power density to 100 $\mu W/cm^3$ through scaling active surface areas, enhancing radioactive source intensity, and refining assembly architectures. Such advances will enable practical applications in autonomous sensors for industrial infrastructure, environmental monitoring, and other fields where long-lasting, maintenance-free power is critical.

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About DIAMFAB

DIAMFAB is an internationally recognized pioneer in semiconductor diamond. Founded in 2019 and based in Grenoble (France), DIAMFAB is a spin-off from the Centre National de la Recherche Scientifique (CNRS). The startup is led by Gauthier Chicot, Khaled Driche, and Ivan Llaurado and currently employs 26 people.

DIAMFAB develops and synthesizes high-value diamond wafers for the semiconductor industry and designs associated electronic component architectures.

As a mission-driven company, DIAMFAB aims to commercialize and promote diamond-based semiconductor solutions to enhance the relevance and efficiency of energy transition and sovereignty technologies.

Website: *www.DIAMFAB.com*

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