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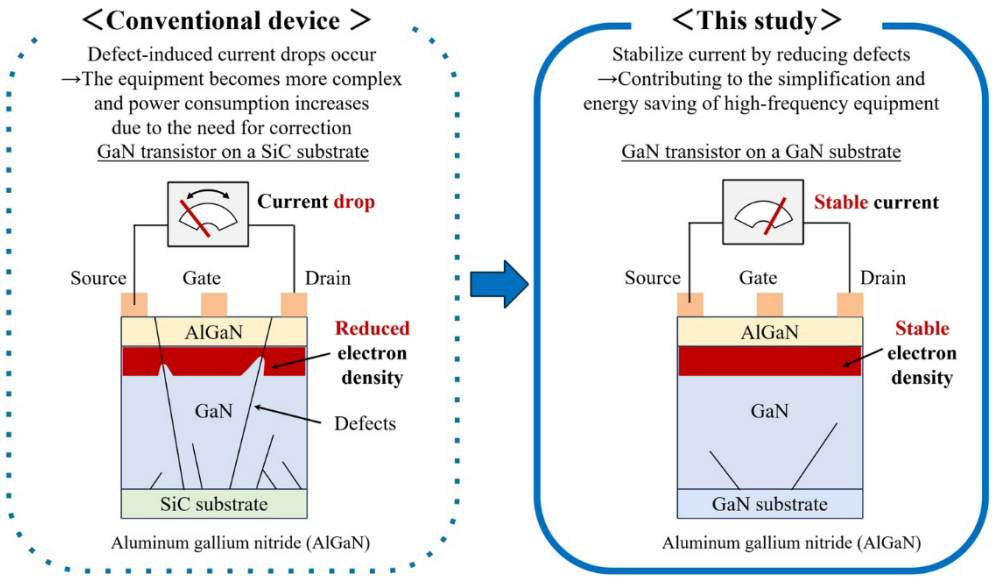
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Mitsubishi Electric Achieves World's First Demonstration of Suppression of Frequency Dispersion in GaN Transistors Using GaN Substrates

Contributing to improved performance and lower power consumption of high-frequency equipment by demonstrating the inherent performance of GaN



Comparison of crystal defects in GaN epitaxial layers on SiC and GaN substrates

TOKYO, November 9, 2026 – Mitsubishi Electric Corporation (TOKYO: 6503) announced today that it has, for the first time in the world,[1] elucidated the effects of frequency dispersion[2] caused by crystal defects in a gallium nitride (GaN) transistor, a high-frequency transistor fabricated by depositing a GaN epitaxial layer[3] on a GaN substrate, and demonstrated that frequency dispersion can be significantly suppressed.

This achievement makes it possible to consistently realize the inherently high performance of GaN, contributing to the miniaturization, improved performance, and lower power consumption of high-frequency equipment, including industrial microwave heating systems that use GaN transistors.

In recent years, demand for high-power, high-efficiency GaN transistors has been rapidly increasing in high-frequency fields, including industrial microwave heating systems used for chemical recycling, which converts

[1] According to research conducted by Mitsubishi Electric on October 26, 2026; 156 research papers were identified through a Google Scholar™ search using the keywords "GaN substrate," "GaN wafer," and "GaN on GaN HEMT," and then reviewed.

[2] A phenomenon in which current values and other characteristics of high-frequency devices vary depending on the operating frequency.

[3] A single-crystal layer grown on a single-crystal substrate.

waste plastics back into chemical raw materials, as well as 5G/6G base stations and radar systems. Conventional GaN transistors have mainly been fabricated by forming a GaN epitaxial layer on a silicon carbide (SiC) substrate because SiC has high thermal conductivity and provides effective heat dissipation. However, crystal defects have been unavoidable during the film formation process due to the difference in materials between the substrate and the epitaxial layer.

These crystal defects impede the movement of electrons during high-frequency operation, causing frequency dispersion, in which current values vary depending on the frequency, and resulting in unstable device operation. Consequently, complex correction using digital circuits had previously been required, making increased overall system size and greater power losses significant challenges.

As part of a project commissioned by Japan's Ministry of the Environment,[4] Mitsubishi Electric has elucidated the effects of crystal defects on frequency dispersion through device characterization of GaN transistors incorporating GaN substrates,[5] an area in which Japanese companies have particular strengths, using a new circuit analysis method that incorporates defect-related response.[6]

By demonstrating, for the first time in the world, that frequency dispersion can be significantly suppressed on a GaN substrate and that flat frequency characteristics can be obtained, Mitsubishi Electric has made it possible to simplify the digital correction circuits that had previously been essential. This will contribute to the miniaturization, improved performance, and lower power consumption of high-frequency equipment.

Details will be presented at the International Workshop on Nitride Semiconductors 2026 (IWN2026), to be held from November 8 to 13 at Kumamoto Castle Hall in Kumamoto City, Japan.

Features

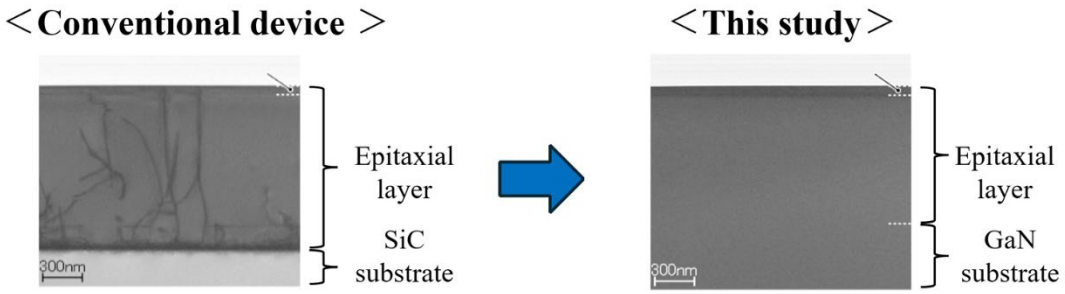
1) World's first elucidation of the effects of crystal defects on frequency dispersion and demonstration of frequency dispersion suppression

- By comparing the crystal structures of GaN epitaxial layers formed on SiC and GaN substrates and applying a new circuit analysis method incorporating defect-related response, Mitsubishi Electric became the first in the world to elucidate the effects of crystal defects generated during conventional film formation on SiC substrates on frequency dispersion during high-frequency operation.
- Electrically confirmed the advantage of improved crystal quality on a GaN substrate and demonstrated, for the first time in the world, significant suppression of frequency dispersion.
- Clearly demonstrated, for the first time, the usefulness of GaN substrates, an area in which Japanese companies have strengths, for high-frequency devices.

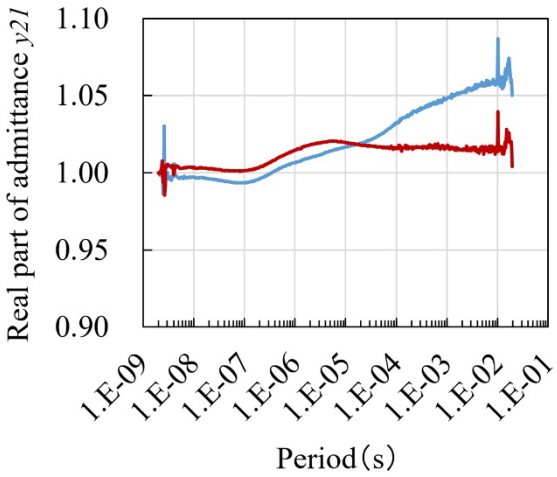
[4] Mitsubishi Electric has been participating since 2024 in the Project "Acceleration of Social Implementation and Dissemination of Components and Materials for Realizing Innovative CO_2 Emission Reduction" by Ministry of the Environment, Japan and is conducting technological development related to high-efficiency GaN transistors.

[5] Using a substrate made entirely of GaN that can be handled independently.

[6] The electrical response or behavior exhibited by defects in a material in response to external stimuli.



Comparison of the crystal quality of GaN epitaxial layers on SiC and GaN substrates



Variation in current flow with the period of the high-frequency signal (frequency dispersion)

Blue: GaN transistor on a SiC substrate; Red: GaN transistor on a GaN substrate

2) Simplification of GaN transistor circuit design and reduction in power consumption

- By significantly suppressing frequency dispersion caused by crystal defects—a longstanding issue—complex correction using digital circuits, which was previously required, is no longer necessary. This contributes to the simplification of GaN transistor circuit design and the reduction of power consumption.
- This contributes to the downsizing, improved performance, and lower power consumption of high-frequency equipment, including industrial microwave heating systems and communication base stations that use GaN transistors.

Feature Development

Based on this achievement, Mitsubishi Electric will pursue further increases in the output power and efficiency of GaN transistors and consider applications in industrial microwave heating systems, high-frequency communication equipment, and radar systems, with the aim of practical deployment around 2030.

Reference

These research results were obtained from the Project “Acceleration of Social Implementation and Dissemination of Components and Materials for Realizing Innovative CO_2 Emission Reduction” by Ministry of the Environment, Japan.

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About Mitsubishi Electric Corporation

Guided by its corporate philosophy, Mitsubishi Electric Corporation (TOKYO: 6503) places sustainability at the core of its operations and values stakeholder trust—encompassing society, customers, shareholders and employees. In pursuing profitability, capital efficiency and growth, Mitsubishi Electric works closely alongside customers to develop value-added solutions that address today's complex challenges while enhancing the company's sustainable corporate value.

Founded in 1921, Mitsubishi Electric has over a century of experience in delivering reliable, high-quality products and solutions. With over 200 group companies and approximately 150,000 employees worldwide, the company is a recognized global leader in manufacturing, marketing and selling electrical and electronic equipment and systems across a broad range of sectors, including public utility systems, energy systems, defense and space systems, factory automation systems, automotive equipment, building systems, air conditioning systems & home products, digital innovations, and semiconductor & devices.

Mitsubishi Electric recorded consolidated revenue of 5,894.7 billion yen (U.S.$ 36.8 billion*) in the fiscal year that ended on March 31, 2026. For more information, please visit www.MitsubishiElectric.com

*JPY 160=USD 1, the approximate rate on the Tokyo Foreign Exchange Market on March 31, 2026