

Project Title: Semi-Insulating GaN Substrates for PCSS (scheduled for 2025-2028)

Entrusted Parties: Mitsubishi Chemical Co. Ltd., The University of Tokyo

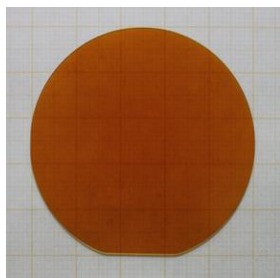


Outline of the Project

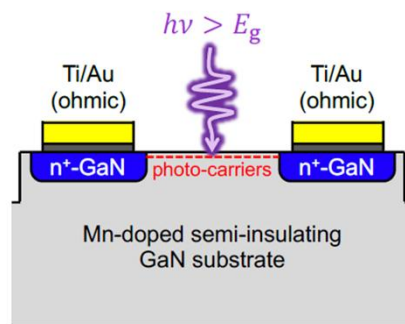
Background: To achieve carbon neutrality by 2050, we need to promote research and development to improve power-control performance that supports integrating renewable energy into the grid.

Objective: To mitigate the electromagnetic noise generated by high-speed on/off switching of high-voltage power transistors, we will develop semi-insulating GaN substrates for photo-conductive semiconductor switches (PCSS).

Research and development methods: Using the ammonothermal method to grow large-diameter, low-dislocation crystals, we will develop semi-insulating GaN crystals and substrates suitable for PCSS to rapidly improve the performance and adoption of GaN-based PCSS.

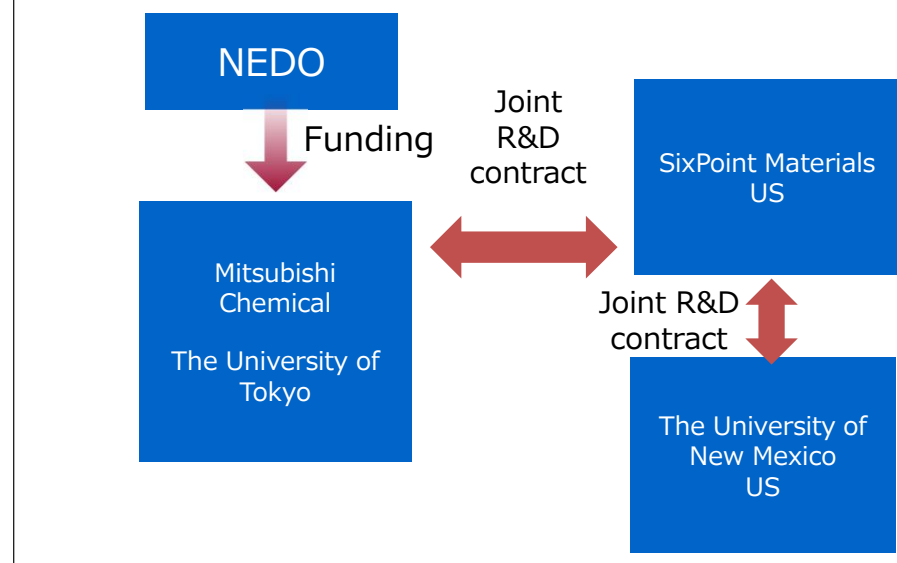


Mn-doped GaN



PCSS device

Project Scheme



Expected Outcomes

- The results of this research will be applied to semiconductor switches for circuit breakers in high-voltage, direct-current transmission networks that utilize power derived from renewable energy sources. We aim for introduction into power infrastructure in the late 2030s.
- The decarbonization effects from this technology are estimated to be approximately 35 million tons of CO₂ reduced between 2040 and 2050.
- The properties of GaN substrates are expected to be applicable in industrial high-power laser processing equipment and high-speed optoelectronic communication devices. A 50% market share is the ultimate goal.

Significance of International R&D

This research integrates the strengths of Mitsubishi Chemical (acid ammonothermal method), SixPoint Materials (basic ammonothermal method), the University of Tokyo (device evaluation), and the University of New Mexico (analysis) to realize high-performance GaN-PCSS that would be difficult to achieve with conventional technologies.