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Successful metalorganic vapor phase epitaxy of β-gallium oxide crystals
～Accelerating the realization of a carbon-free society through next-generation power devices～

In collaboration with Dr. Hideaki Machida (President) and Dr. Masato Ishikawa of Gas-Phase Growth Ltd. and Mr. Kazutada Ikenaga of Taiyo Nippon Sanso Corporation (President: Kenji Nagata), Professor Yoshinao Kumagai and Assistant Professor Ken Goto of Division of Applied Chemistry, Institute of Engineering, Tokyo University of Agriculture and Technology (President: Kazuhiro Chiba), have revealed the chemical reaction mechanism of vapor phase growth of β-gallium oxide (β-Ga_2O_3) crystals (Note 1), which are attracting attention as materials for next-generation power devices with high energy-saving effects. The metalorganic vapor phase epitaxy (MOVPE) method (Note 2) was used to demonstrate the growth of high-purity β-Ga_2O_3 crystals under optimal growth conditions. These results hold promise to lead to the development of mass-production MOVPE equipment for β-Ga_2O_3 devices, and the practical application of β-Ga_2O_3 power devices for a decarbonization society.

Please refer to the Japanese Journal of Applied Physics (abbreviated as JJAP) on March 29 for the results of this study.

Title: Thermodynamic and experimental studies of β-Ga_2O_3 growth by metalorganic vapor phase epitaxy

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(Note 1) β-gallium oxide (β-Ga_2O_3)

An oxide semiconductor crystal in which gallium (Ga) and oxygen (O) atoms are combined in a stoichiometric ratio of 2 : 3. Its band gap is about 4.5 eV, which is larger than that of Si (1.1 eV), 4H-SiC (3.3 eV) and GaN (3.4 eV).

(Note 2) Metalorganic Vapor Phase Epitaxy (MOVPE)

A method of crystal growth using organometallic compound gases as raw material. The film thickness can be controlled with a precision of one atomic layer, and it is widely used as a method for fabricating compound semiconductor devices that require nanometer-order* structure design. It is widely used in the fabrication of nitride semiconductor light-emitting devices and high-speed transistors, but has not been investigated in oxide crystal growth due to the high reactivity of oxygen with organometallic compounds.

* 1 nanometre is one billionth of a metre

◆Research-related inquiry

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