Gallium Oxide Power Device Technologies: Current Status and Prospects

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Masataka Higashiwaki received the B.S., M.S., and Ph.D. degrees from Osaka University, Osaka, Japan, in 1994, 1996, and 1998, respectively, all in solid-state physics.

In 2000, he joined the Communications Research Laboratory (CRL), Tokyo, Japan, as a Researcher, where he was engaged in research and development on MBE growth and device processing of group-III nitride-based transistors. From 2004 to 2007, he was a Senior Researcher of the National Institute of Information and Communications Technology (NICT), which was renamed from CRL in 2004. From 2007 to 2010, he took a temporary leave from NICT and joined the Department of Electrical and Computer Engineering, University of California, Santa Barbara as a Project Scientist. He returned to NICT in 2010 and started a pioneering work on gallium oxide-based electronics. He is currently a Director at the Green ICT Device Advanced Development Center, National Institute of Information and Communications Technology, Tokyo, Japan. His current research interests are in wide bandgap semiconductor electronics with main focuses on gallium oxide transistors and diodes.

Abstract

Gallium oxide (Ga_2O_3) possesses excellent material properties represented by its large band gap of about 4.5 eV, especially for power device applications. It is also attractive from an industrial viewpoint since large-size, high-quality wafers can be manufactured by using simple melt growth methods. These two features have drawn much attention to Ga_2O_3 as a strong contender following SiC and GaN for future power devices.

This lecture will discuss the recent progress in development on fundamental technologies for Ga_2O_3 devices, covering wafer production from melt-grown bulk single crystals, homoepitaxial thin-film growth technologies, as well as device processing and characterization of field-effect transistors and Schottky barrier diodes.