

Advances and Prospects of Gallium Oxide Material and Device Technologies

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Gallium oxide (Ga_2O_3) is not a novel material and has a long history of more than 60 years. Especially, it has been well recognized as a native oxide formed on GaAs and GaN. However, as a semiconductor material, single-crystal Ga_2O_3 had been largely ignored by a great majority of researchers and engineers, even though it possesses attractive material properties such as an extremely large bandgap energy of 4.5 eV, a projected large critical electric field of over 7 MV/cm, and availability of large-diameter single-crystal wafers produced from melt-grown bulks. This situation changed in 2011, with our demonstration of first single-crystal Ga_2O_3 field-effect transistors (FETs) [1]. Since then, Ga_2O_3 has attracted much attention as an emerging semiconductor, especially due to high expectations for applications to future power switching and harsh environment electronics [2, 3]. Now, Ga_2O_3 has been widely recognized as a key material among ultrawide bandgap semiconductors, which are defined by bandgap energy exceeding those of SiC and GaN.

In this talk, after a brief introduction of material properties of Ga_2O_3 , state-of-the-art Ga_2O_3 material and device technologies will be introduced, based on world-wide recent research activities conducted by both our group and external research organizations. In addition, a brief outlook on Ga_2O_3 device applications will be given.

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