

Current Status and Future Prospects of GaN Substrates for Green Devices

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Recently, single-crystal substrates applied to optoelectronic devices, such as sapphire, GaN, and SiC, have been attracting much attention for use in green devices. At present, they are mainly used for the blue-violet semiconductor laser that is applied as the light source of Blu-ray disc equipment. In the near future, it is highly likely that they will be introduced into white LEDs used for lighting and LCD backlight, power transistors to be used for power converters, and also into power semiconductors such as power diodes, leading to the rapid growth of the green device market involving GaN, SiC and diamond. These single-crystal substrates are expected to serve as a trigger to realize a low-carbon and low-energy society, complying with the projected cutbacks of power and CO₂ emission by 70 billion kWh and 40 million tons per year, respectively. This is why they are referred to as “green devices”. In this paper, we will discuss the recent approaches that are in progress to develop new devices, taking GaN substrates as an example. Furthermore, we will review current problems and future perspectives for the most critical issue of realizing large substrates, as well as for the crystal growth method and manufacturing process that affect crystal quality.

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