Crystal Growth and Planar Defects of β-Ga_2O_3 Single Crystal

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As one of the ultra-wide bandgap semiconductor materials, β-Ga_2O_3 has a bandgap of up to 4.8 eV, which has the advantages of transparent conductivity, controllable doping and low cost [1,2]. Therefore, β-Ga_2O_3 has great application prospects in deep-ultraviolet photodetectors and high power devices[3–5]. It is of great significance to grow β-Ga_2O_3 crystals with large size and high quality. At present, we have successfully prepared 4-inch β-Ga_2O_3 single crystal using edge-defined film-fed growth (EFG) method. The full-width at half-maximum (FWHM) of rocking curve of (400) was 57.57 arcsec and the average dislocation density was estimated of 1.06×10^4 cm^{-2}, indicating that the crystal has high quality. Besides, the electron concentration of the as-grown crystal was 7.77×10^{16} cm^{-3}. In order to further improve device performance, the study of crystal defects is also essential. Our research group has characterized the microstructure of the low angle grain boundary and twin boundary that belong to planar defects in β-Ga_2O_3 crystal, and obtained that the misorientation angle of the low angle grain boundary was about 3°. In addition, it was found that the existence of low angle grain boundary will destroy the integrity of the crystal structure, resulting in the double peaks and broadening of the X-ray rocking curve. This work fills up the research gap of the low angle grain boundary defects in β-Ga_2O_3 crystals.

References

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