高感度エミッション顕微鏡による(001)β型酸化ガリウムショットキーバリアダイオードの漏れ電流の観察

Observation of Reverse Leakage Current in (001) β-Gallium Oxide Schottky Barrier Diodes by High Sensitive Emission Microscope

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1. Introduction

β-Gallium oxide (β–Ga_2O_3) possesses a wide bandgap of 4.8 eV which makes this material more preferable for high-power electronic devices. Besides, large size single crystal of β-Ga_2O_3 can be achieved from melt growth techniques that are economically beneficial for large-scale device fabrication. However, crystal defects in this material are the main obstacle for the reliability of device operation [1-2], yet their impact on device characteristic is not clearly known. Therefore, in this study, by utilizing a high sensitive emission microscope, we investigate and identify the origin of reverse leakage current in β-Ga_2O_3 Schottky barrier diodes (SBDs).

2. Fabrication and Measurements

Vertical-type EFG-grown (001) β-Ga_2O_3 SBDs were fabricated and investigated. Ni/Au was evaporated on the surface to form Schottky barrier contacts, and Ti/Au was evaporated on the back face to form ohmic contact. SBDs were observed from the back face by the emission microscope with a high sensitive CCD camera during reverse bias operation. After the emission microscope observation, the Schottky contacts and the surface were etched to form etch pits and patterns.

3. Results and discussion

Figure 1 shows emission microscope image of SBD with a diameter of 500 μm taken at a reverse bias of -70 V with a current of -440 μA. As the increase of the reverse leakage current, the number of emission spots were increased. This proves that the emission spots originate from leakage current. As shown in Fig. 2, we found etch pits were observed at the emission spots. The investigation of these etch pits is still in progress. A part of this work was supported by NEDO.

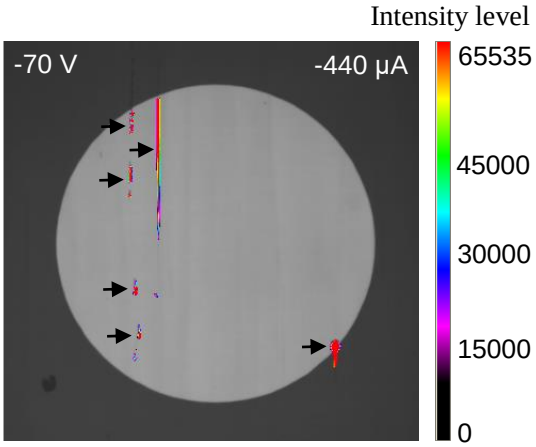

Fig. 1. Emission microscope image of SBD with a diameter of 500 μm under the reverse bias of -70 V with current of -440 μA.

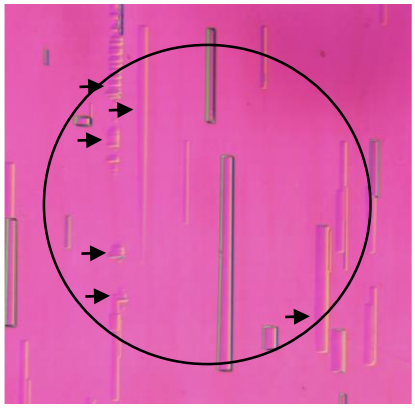

Fig. 2. Differential interference microscope image of the same position of SBD in fig.1 after etching.

References

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