

Development of GaN Semiconductor X-ray and Gamma-Ray Detectors

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CdTe is an excellent material for semiconductor X-ray detectors that can be operated at room temperature, but its K-edge around 30 keV results in a low line attenuation coefficient in the lower energy region. We propose gallium nitride (GaN) as a new semiconductor detector material, which has a higher linear attenuation coefficient than CdTe in the low energy region of about 10 to 26 keV and can be operated at room temperature. Despite these promising properties, sufficient experimental data as a radiation detector has not been obtained. In this study, we first calculated the probability of X-ray detection with respect to the thickness of the depletion layer of the detector. As a result, we fabricated a vertical pn diode and pin diode detector, because it is difficult to realize it in a horizontal structure. Then, to confirm that a diode structure was formed, we performed I-V measurements, which confirmed the diode structure. On the other hand, it is difficult to detect γ -rays with the detector fabricated at the present stage because the required thickness of the depletion layer is not sufficient. Therefore, we evaluated radiation characteristics by detecting α -rays, which have lower penetrating power than γ -rays. Since α -rays could be detected, we believe that γ -rays can be detected if the thickness of the depletion layer can be increased. Details will be discussed on the day.

Topics

Session A. Physics of condensed matter and spectroscopy

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