Development of THz Zero-bias Detector for Industry Applications

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The detection methods used in the terahertz (THz) frequency band can be classified into three categories: direct, homodyne, and heterodyne detection. Direct detection is a favorable choice for industrial applications in the THz range due to its simplicity and ease of setup, making it accessible even for non-specialists in the fields of terahertz and optics. In this research, we optimized the epilayer and device structure of InGaAs-based Schottky barrier diodes (SBDs) to enhance their THz response. We developed various forms of SBD modules, including those integrated with broadband antennas and designed with WR3.4 waveguides for various applications. Furthermore, to ensure high reliability and stability in various external environmental conditions, we fabricated SBD modules with hermetic packaging. The housing was made from Kovar material, known for its high thermal conductivity, and silicon submounts and hermetic epoxy were used in the final assembly. These assemblies successfully passed the He leak test, demonstrating a leak rate of 1×10-7 atm•cm3/sec. In addition, we developed a real-time slurry thickness measurement system in the fuel cell manufacturing process using ETRI UTC-PD and SBD modules. These THz components have the potential to be utilized in various applications, including non-destructive evaluation techniques in industrial settings and other fields.