

EDP1-9

Development of Superconducting Single-Photon Detector(SSPD) using molybdenum nitride thin film

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In recent years, there is an increasing demand for high-performance single photon detectors in a wide range of research fields including quantum information communication and quantum optics. Among them, SSPD is a detector having a single photon sensitivity from the ultraviolet region to the mid-infrared region (0.3 μm to 0.5 μm). Furthermore, its excellent performance of high sensitivity and high speed response is expected to be applied to future communications. The superconducting material used greatly affects the detector performance. Currently, niobium nitride (NbN) is often used as a superconducting material for SSPD. However, this study focused on molybdenum nitride (MoN) as a new material. The reason is that MoN has a maximum T_c slightly lower than NbN, but has an electron-lattice relaxation time that is one order of magnitude longer. As a result, a detector with higher internal detection efficiency than that using NbN is obtained. Furthermore, we succeeded in developing the SSPD using MoN with high system detection efficiency by adding a cavity structure and an anti-reflection coating layer. This work is supported in part by JSPS KAKENHI 18K04255 and by the Cooperative Research Program of "NJRC Mater. & Dev."

Keywords: SSPD, MoN