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Development of Optical Transition Edge Sensor Array for Photon Imaging

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Transition edge sensors (TES) exhibiting high energy resolution of a single optical photon have been applied to photon-counting microscopy for biological imaging¹. We are aiming to develop multi device TES showing large effective area in order to improve measurement efficiency of photon-counting microscopy. We fabricated 3×3 array TES where single device exhibits dimension of $8 \mu\text{m} \times 8 \mu\text{m}$ and film thickness of Ti 20 nm and Au 10 nm on Si substrate as shown in Fig. 1 (a). It must be checked whether each device in array TES on Si without membrane structures which keep thermally each device away operates independently or not. At first, we operated the device A and B in Fig. 1 (a) at once to obtain P - V curve of the device A as shown in Fig. 1 (b) $P_{\text{B}} = 52 \text{ pW}$. Joule power of the device A at 2 devices operating stayed about the same as that at single device operating, $P_{\text{B}} = 0 \text{ pW}$. Next, we operated the device A and B at once so that power of the device B equaled the sum of power of the 8 devices next to the device A instead of the 9 devices operating at once to obtain P - V curve of device A as shown in Fig. 1 (b) $P_{\text{B}} = 470 \text{ pW}$. Although joule power of the device A at $P_{\text{B}} = 470 \text{ pW}$ was smaller than that at $P_{\text{B}} = 0 \text{ pW}$ by 21%, electro thermal feedback on the device A at $P_{\text{B}} = 470 \text{ pW}$ worked. Static thermal influence from neighbor devices was revealed. Dynamic thermal crosstalk is investigated by measurement of signal response.

1 K. Niwa et al., *Sci. Rep.*, 7, 45660 (2017).

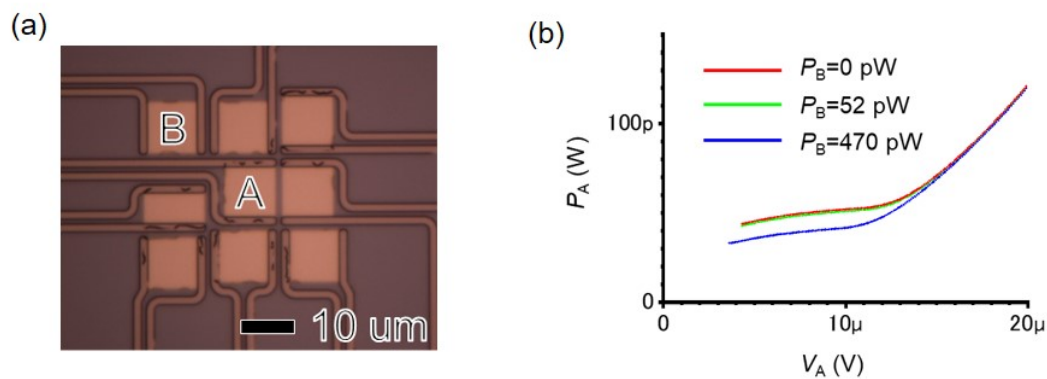


Figure 1: (a) 3×3 array TES where single device exhibits dimension of $8 \mu\text{m} \times 8 \mu\text{m}$ and film thickness of Ti 20 nm and Au 10 nm on Si substrate. (b) P - V curve of the device A at power of the device B (P_{B}) of 0 pW, 52 pW, and 470 pW. P_{B} is power of the device A. V_{A} is voltage of the device A.

Less than 5 years of experience since completion of Ph.D

Y

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