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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 μ m×8 μ 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*_B = 52 pW. Joule power of the device A at 2 devices operating stayed about the same as that at single device operating, *P*_B = 0 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 at *P*_B = 0 pW by 21%, electro thermal feedback on the device A at *P*_B = 470 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 $8 \ \mu m \times 8 \ \mu m$ and film thickness of Ti 20 nm and Au 10 nm on Si substrate. (b) {\it P}-{\it V} curve of the device A at power of the device B ({\it P}{\tiny B}) of 0 pW, 52 pW, and 470 pW. {\it P}{\tiny B} is power of the device A. {\it V}{\tiny A} is voltage of the device A.

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

Student (Ph.D., M.Sc. or B.Sc.)

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