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Study of the fabricating multilayer absorber with the aim of improving detection efficiency of TES X-ray micro calorimeter array

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We developed a TES X-ray micro-calorimeter array with Cu/Bi bilayer absorbers. The bilayer was fabricated with electrodeposition. For the future X-ray astronomy applications such as Diffuse Intergalactic Oxygen Surveyor (DIOS) mission, X-ray absorbers with high spatial covering factor is essential. An example is so-called mushroom-shape absorbers that cover the dead space between the pixels. In applications like DIOS, we also would like a relatively large (~0.5mm) pixels. This will degraded the energy resolution because of an increase in the heat capacity and the possible dependence of pulse shapes on X-ray absorption points on the absorber. Bismuth. is ideal material for absorber because of the low specific heat and high X-ray stopping power. However very low heat conductance is likely produce pulse shape variations. In order to improve thermal conductance, it is used with high-thermal-conductance material like copper. In this paper we report Bi/Cu bilayer fabricated with electrodeposition. We first fabricated Cu and Bi membranes separately and measured the 4K to room temperature resistance ratio (RRR). The thermal conductance of the two layers were estimated be enough high for an absorber of the size, 120 x 120 μm2 and 1 and 1 micro m thicknesses for Bi and Cu. We fabricated TES microcalorimeter array with Cu/Bi absorbers. The energy resolution was 20 eV at 6 keV. The relatively low energy resolution is partly due to the high transition temperature (300mK) of the device, but partly due to the pulse-to-pulse variations of

the pulse decay time constant. We observed the structures of Cu/Bi absorber with FIB. As a result, we found that there were oxidation film and void between Cu and seed layer. We plan to improve the fabrication process so that we can avoid oxidization film and void between Cu and seed layer.