Material Study for a THz SIS Mixer

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***Abstract*—**The highest frequency reported for an SIS based mixer is 1.25 THz, as demonstrated with the Herrschel Band 5 receiver (Karpov, 2008). At NAOJ, we are in the early stage of developing the technology for a wave guide coupled SIS mixer that can be operated at frequencies up to 1.5 THz. Our target is to integrate high-gap junctions, e.g. V_{gap} > 4 mV, with low loss micro strip lines made from the layer stack Nb(epitaxial) / SiO_2 / Al which is in part similar to above mentioned Herrschel mixer. As for high-gap junctions, with high current density and low leakage, the most advanced technology is based on NbN(epi)/MgO/NbN tri-layers and has been reported by Dmitriev (ISSTT 2012). One of the challenges is that epitaxial quality Nb and NbN films can be grown only on certain substrates, e.g. sapphire for Nb and MgO for NbN, both of them difficult to thin down to ~10 μm thickness which is required when mounting devices into a THz wave guide. Recently, we started experimenting with Si/SiC as a substrate where the ~1 μm SiC buffer layer is grown by chemical vapor deposition. Nb films deposited by magnetron sputtering and at elevated substrate temperatures of 800 ^{o}C show electron diffraction patterns suggesting single crystal quality. We will present results on Nb film characterization through X-ray spectroscopy and electrical measurements and discuss the prospect of combining these Nb films with all-NbN SIS junctions.