

Al/SiO₂/Al Micro Strip Lines for THz SIS Mixers

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Abstract—Future wave-guide coupled SIS mixers for the supra THz range will most likely rely on normal metal embedding circuits since high quality superconductors that can be grown on quartz substrates and whose f_{gap} substantially exceeds 1 THz are currently not available. We have fabricated Al / SiO₂ / Al micro strip lines, integrated with standard Nb/AlO_x/Nb SIS junctions (already explored by several groups back in the 1990s [1]), and make a direct comparison with strip lines based on NbTiN/SiO₂/Al. The latter `hybrid type` has been extensively studied in our lab in the course of developing mixers for the ALMA Band10 receiver and low loss performance has been demonstrated in the 790-950 GHz range. Both types of strip lines are made on the same wafer and evaluation of resonant phenomena allow us to estimate the phase velocity and rf losses at frequencies up to ~1.2 THz. We propose a new mixer design using these Al/SiO₂/Al strip lines, compared with the NbTiN/SiO₂/Al based circuit we expect additional coupling losses of 30–50 % depending on the resistivity of the Al films.

[1] M. Bin et.al., Appl. Phys. Lett. 68, 1714 (1996)