

NIOBIUM-GOLD BI-LAYER HEB MIXERS

Irfan Siddiqi and Daniel E. Prober
Dept. of Applied Physics, Yale University
15 Prospect St., New Haven CT 06514

Hot-electron bolometer (HEB) mixers are promising candidates for use in terahertz heterodyne receivers. Based on microwave measurements, we have shown that the properties of diffusion-cooled HEBs scale with the critical temperature (T_c). Lower critical temperature mixers have greater sensitivity (mixer noise temperature scales with T_c) but are more prone to saturation effects. Nb-Au devices have a bi-layer microbridge that consists of a thin layer of Nb with a thin layer of Au on top. The presence of the normal metal (Au) lowers the T_c of the microbridge due to the S-N proximity effect. For a given application, the optimum critical temperature is determined from the scaling data. A HEB mixer with this T_c can then be fabricated by choosing an appropriate thickness of Au to be deposited on top of the Nb. We present the experimental results and model calculations. Current work is focused on fabricating Nb-Au devices for use in sub-millimeter receivers, and characterizing the level of variation in mixer performance from device to device.