NbTiN Hot Electron Bolometer Waveguide Mixers on Si_3N_4 Membranes at THz Frequencies

Patrick Pütz, Karl Jacobs, Matthias Justen, Florian Schomaker,
Michael Schultz, Stephan Wulff, and C. E. Honingh

Abstract - We report on NbTiN hot electron bolometer (HEB) mixer design and fabrication for the 1.4, 1.9 and 2.5 THz frequency bands. The mixers under discussion are our contribution to the multi-band single-pixel receivers of the German Receiver for Astronomy at Terahertz Frequencies (GREAT), which is a first light instrument for the airborne Stratospheric Observatory for Infrared Astronomy (SOFIA), and the focal plane array receiver on the balloon-borne Stratospheric Terahertz Observatory (STO). We measure device noise vs. intermediate frequency (IF) and analyze the receiver system output power stability and IF band ripple with newly developed SiGe low-noise amplifiers from the S. Weinreb group (Caltech). The mixers use waveguide technology with the device coupled to the fundamental waveguide mode via an integrated probe antenna. The device is electrically connected through beam leads, which reliably suspend the 2 µm thin Si_3N_4 membrane with micrometer mounting precision. Electron beam lithography defines the 400 nm long and 4 nm thick NbTiN microbridges and a novel deep reactive-ion etch is used for shaping of the substrates.

Index Terms - Allan variance, hot electron bolometer (HEB) mixer, radio astronomy, terahertz receiver.

IEEE/CSC & ESAS European Superconductivity News Forum (ESNF), No. 15, January 2011
The published version of this manuscript appeared in *IEEE Transactions on Applied Superconductivity* 21, Issue 3, 636 - 639 (2011)