

Terahertz response of YBCO HEB homodyne detectors

A. Hammar*, S. Cherednichenko, and S. Bevilacqua

*Terahertz and Millimetre Wave Laboratory, Department of Microtechnology and Nanoscience,
Chalmers University of Technology, SE-41296 Göteborg, Sweden*

* Contact: arvidh@chalmers.se

We report on the direct response of hot electron bolometers (HEB) used as homodyne detectors. These bolometers were tested at frequencies 0.1-1.6 THz and for a range of temperatures around 77 K. A logarithmic spiral antenna on a silicon lens was used, providing a broad frequency coverage (well above 1 THz). The measured responsivity ranged from 100 to 500 V/W depending on temperature and RF signal frequency, with RF signal power referenced at the input of the silicon lens. Corrections were made for losses in the cryostat window and polarization losses between the signal and antenna. The response time was about 3 ns. With the room temperature readout we estimate the noise equivalent power to be about 1 nW/Hz^{1/2}. The bolometer bridges have nominal dimensions 1 μm x 2 μm x 50 nm and are fabricated on sapphire substrates using UV photolithography. A gas laser was used as source for 1.6 and 0.7 THz RF signals, backward wave oscillators at 0.5 THz and Gunn diodes at 0.1 THz. The obtained results show that YBCO bolometers have good prospects for various applications in the terahertz range as fast direct detectors as well as broadband mixers.