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Ti hot electron bolometers with Johnson noise readout for terahertz radiation detection

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Johnson noise thermometry is a primary measurement technique that can be used to probe the thermal transport and thermodynamic properties of hot electrons in conductors. With this technique, a hot electron bolometer (HEB), consisting of a 20 nm thick titanium (Ti) microbridge and a niobium (Nb) log spiral antenna, was developed for terahertz radiation detection. The Nb antenna with large energy gap is used as a superconducting Andreev reflector to confine the hot electrons in the Ti microbridge. We measured the thermal conductance and electrical noise equivalent power (NEP) of the Ti bolometer at different bath temperatures. We found that the thermal conductance of the Ti bolometer has a temperature dependence of Tn with the index n=2.2. The measured NEP of the Ti bolometer shows similar temperature dependence. At a bath temperature of 3.0 K, the measured NEP is found to be about 20.9 pW/Hz0.5. Using 285/77 K blackbody loads, we also performed the optical NEP measurement at 3.0 K. The measurement shows the Ti bolometer has an optical NEP of ~48.9 pW/Hz0.5.

Less than 5 years of experience since completion of Ph.D

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Student (Ph.D., M.Sc. or B.Sc.)

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