Abstracts

Terahertz Shapiro Steps in High Temperature SNS Josephson Junctions

P.A. Rosenthal and E.N. Grossman. "Terahertz Shapiro Steps in High Temperature SNS Josephson Junctions." 1994 Transactions on Microwave Theory and Techniques 42.4 (Apr. 1994, Part II [T-MTT]): 707-714.

We have studied the far infrared behavior of high-T/sub c/ superconductor-normal metal-superconductor (SNS) micro-bridges with T/sub c/ >8.5 K and critical current-resistance products (I/sub c/R/sub N/) as high as 10 mV at 4 K. These are the highest I/sub c/R/sub N/ products reported to date for microfabricated Josephson junctions of any material. The junctions were integrated at the feeds of planar log-periodic antennas made from Au thin films. The junctions had dc normal state resistances R/sub N/ between 6 and 38 Omega, reasonably well matched to the antenna's estimated RF impedance of 53 Omega. Far infrared laser radiation at 404, 760, and 992 GHz induced distinct Shapiro steps (i.e. constant voltage steps at voltages n (hf/2e), n = 1, 2, . . .) in the current voltage characteristics as well as modulation of the critical current. Steps were observed at voltages up to 17 mV and 6 mV, at temperatures of 9 K and 57 K, respectively. This corresponds to maximum Josephson oscillation frequencies of 8 and 3 THz at these temperatures. These are the first far infrared measurements performed on high T/sub c/ junctions. Measurements of the power, frequency, and temperature dependence of the Shapiro steps are presented and discussed in the context of a resistively and capacitively shunted junction (RCSJ) model. A value of 4.5 fF for the junction capacitance is inferred from the hysteresis of the slightly underdamped current-voltage characteristics.

❑ Return to main document.