Q MEASUREMENTS OF SUPERCONDUCTING CAVITIES AT 2.868 GHz*

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ABSTRACT

The behavior of superconducting lead at microwave frequencies was investigated by measuring the quality factor of TE_{011} cavities resonant at 2.868 GHz. The choice of this mode is dictated by the desire to eliminate losses due to electric fields on the walls. The cavity is of the transmission type in which systematic errors can be made negligible by reducing the coupling coefficient. Problems encountered in construction of the cavity and their solution are described. The quality factor of the cavity is measured by a frequency sweep method, in which the cavity is shock-excited by a fast adiabatic passage through resonance. The loaded Q is obtained from the time constant of the decaying eigenoscillations of the cavity. The coupling coefficient is then computed from the amplitude of input and output signals and the sweep rate. Possible systematic errors are discussed and found to be inconsequential. The quality factors were measured as a function of temperature. The highest value measured is $Q = 11 \times 10^9$ at $1.5^{\circ}K$, which was obtained with a 2.5 μm thick layer of lead deposited on electropolished copper. The preparation of the surface and the plating procedure developed is discussed.

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