

Effective Surface Impedance of a High-Temperature Superconducting Film in
Semiconductor Plasma Substrate
at Mid-infrared Frequency

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Abstract

The effective surface impedance of a high-temperature superconducting thin film on a semiconductor plasma substrate is calculated. Two possible configurations are considered. The first one is a superconducting film deposited on a semi-infinite semiconductor substrate. It is seen that there exists a critical film thickness for the superconductor such that a minimum effective surface resistance is attained. The effective surface resistance is strongly dependent on the high-frequency permittivity of semiconductor plasma. The second will be limited to the more practical case, that is, the semiconductor substrate is of finite thickness. The investigation of substrate resonance in the effective surface resistance shows some fundamental distinctions when a semiconductor plasma substrate is introduced.

Keyword : Surface impedance, High-temperature superconductors, Semiconductor plasmas, Impedance transform technique.