

Properties and Applications of HTS-Shielded Dielectric Resonators: A State-of-the-Art Report

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High temperature superconductor (HTS) shielded dielectric resonators (DR's) have demonstrated to provide quality factors Q between 5×10^5 and several 10^6 at frequencies up to 20 GHz and levels of dissipated rf power in the range of Watts. As dielectric materials, high purity single crystals of sapphire, LaAlO_3 , and rutile exhibit sufficiently low microwave losses. There are two main areas of application which are considered to benefit from HTS-shielded DR's, namely low-phase-noise oscillators for radar systems and digital communication, and high-power filters for satellite communication. Projections for phase noise are -145 dBc/Hz at 1 kHz offset from the carrier frequency, a value of -110 dBc/Hz at 1 kHz was measured recently for an oscillator with a carrier frequency of 5.6 GHz. Modeling of filters based on resonators with Q s in the 10^6 range indicates their ability to reduce the rf power dissipation apparent in the output multiplexers of communication satellite payloads. Presently, schemes for resonator coupling and tuning while maintaining high Q s are under development.

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