Design of ultra-wideband bandpass superconducting YBCO filters using step-impedance coupling lines

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ABSTRACT

Compact ultra-wideband (UWB) bandpass filter (BPF) is presented for applications on short-range and high-speed wireless communication.Superconducting YBa2Cu3Oy (YBCO) stepped impedance resonators and coupled-line sections as inverter circuits are designed to form the basic filter structure. In the filter design, connected high-low stepped impedance microstrip lines construct the resonators, and open-stub lines are utilized to add return-loss poles in the pass-band and create transmission zeros in the lower/upper stop-band region. The simulation results show the passband from 3.35 GHz to 7.65 GHz has a 3-dB fractional bandwidth of 78 percent, computed insertion losses better than 0.1 dB and return losses greater than 15 dB. Rejection levels in the upper/lower stop-bands are better than 20 dB. For fabrication, high-Tc superconducting (HTS) YBCO films were deposited on double-side-polished 0.5-mm-thick LaAlO3 (100) substrates by a radio-frequency sputtering system. The filter was made out of patterned double-sided deposited YBCO films integrated with a gold-coated housing. The realized HTS UWB BPF shows wide passband within 3.4-8.7 GHz with a maximum insertion loss of 1.0 dB. The measured results show a good HTS UWB BPF performance. Moreover, the temperature-dependent frequency responses and the insertion loss can be described by the modified two-fluid model based formulas, indicating that the frequency shift in HTS BPF is dominated by the temperature dependence of the magnetic penetration depth.

Keywords : High Temperture Superconducting、YBCO、Ultra-Wideband、Filter

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