Microwave Properties and Applications of HTS Materials: History and Progress

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In this paper a review of properties of High Temperature Superconducting films when exposed to high frequency EM fields, measurements methods of surface resistance and HTS microwave applications in the last twenty five years is given. Most important developments in each of the three areas are reviewed and discussed. The current advances in the field are also summarized, and a brief attempt of "HTS microwave forecast' is presented.

As it is known microwave applications of HTS materials were envisaged as the first mass market application as early as in 1887. This had driven a significant interest in microwave characterization of various HTS materials, fabrication of materials with optimal microwave properties, development of accurate measurement techniques and in their standarisation. Several start-up companies were created to develop HTS filters for cellular Base Station receivers with reduced adjacent band interference, increased coverage and better spectrum utilization. Outstanding HTS filters and Cryogenic Front Receivers Ends were developed with Out of Band Rejection as large as 80dB/MHz or Insertion Loss as small as 0.2dB. This initial hype (fed by media and the financial market) in HTS filters died out, mass market applications never occurred and companies disappeared. However research and development continued on a smaller scale, mostly in Asia. Recent developments include tri-band BPFs (for ISM, WiMAX and WLAN applications), superconducting quadruplexers and new concept HTS high power filters.

Simulation results have shown that high selectivity HTS filters might remove a need for 1 MHz guard bands for planned LTE Public Safety Mobile Broadband in the presence of interference from adjacent Land Mobile Services in the 800MHz Band in Australia. Hence, in opinion of the author, there is room and need for HTS microwave systems in future communication systems.