

On the Nature of Nonlinearities in HTS Thin Films at Microwaves

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Abricosov magnetic vortices generation influence on nonlinearities in YBCO thin films on MgO substrates is researched in Hakki-Coleman Dielectric Resonator (HCDR) at frequency of 25GHz and in microstrip resonators at 1.985GHz. Microwave properties of MgO substrates are studied in split post dielectric resonator (SPDR) at 10.48GHz. Microwave power P was from -18dBm to +30 dBm. Temperature T was from 15K to 90K. YBCO thin films exhibited nonlinear characteristics in form of S-type dependence of surface resistance on microwave power $R_s(P)$ at elevated microwave power levels, when H_{rf} is higher than H_{c1} , in HCDR and in microstrip resonators. MgO substrates did not contribute to nonlinearities in YBCO thin films on MgO substrates in given microwave power and temperature ranges. It is assumed that the pinning of Abricosov magnetic vortices on green phase nano-clusters, oxygen nano-clusters and nano impurities can increase critical current I_c and magnetic field H_{c1} in HTS thin films, enhancing the microwave power handling capabilities of microwave filters at high magnitudes of applied microwave power in mobile wireless communications.¹

¹J.E. Mazierska, Dielectric Resonators as a Possible Standard for Characterisation of High Temperature Superconducting Films for Microwave Applications, Journal of Superconductivity, **10**(2), 73-85 (1997).