MICROWAVE COUPLING OF A NOVEL SUPERCONDUCTING EPR MICRORESONATOR

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Electron paramagnetic resonance (EPR) is a powerful technique used to study and manipulate electron spins in various compounds ranging from functional materials to proteins. Recently, major advances in EPR sensitivity were achieved using planar superconducting microresonators [1,2]. However, microresonators fabricated from low-temperature superconductors have severe limitations for conventional EPR due to their low temperature of operation and susceptibility to the external magnetic field. For this reason, microresonators fabricated from high-T_C superconductors are gaining attention.

Here, we use CST Microwave Studio computational electromagnetics tool to simulate microwave coupling characteristics of a planar EPR spiral microresonator coupled to an antenna via a Bruker MD-5 dielectric ring resonator (Fig. 1). First, we investigate the effect of the microwave antenna on the coupling strength to Bruker MD-5 resonator. After finding the overcoupled position, we explore the characteristics of a planar EPR microresonator on its position and rotation in the dielectric resonator. We also explore the dependence of the frequency of a spiral resonator on its length, while coupled to a co-planar waveguide and the Bruker MD-5 dielectric ring resonator. We compare our simulation results with the experimental observations and further discuss the best coupling geometry.

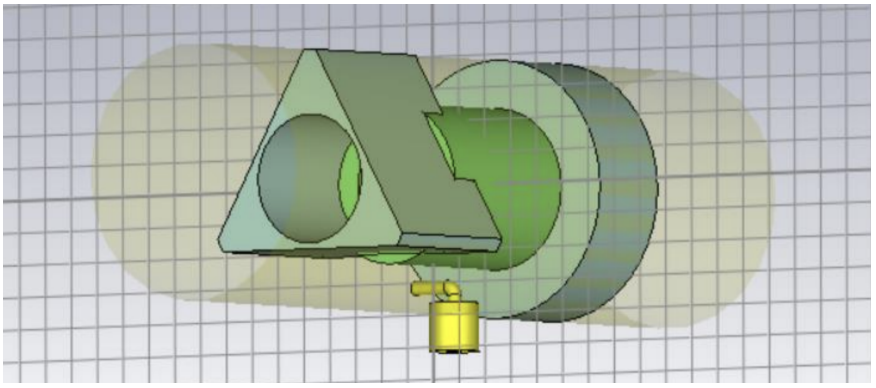

Fig. 1. Model of a Bruker MD-5 dielectric resonator.

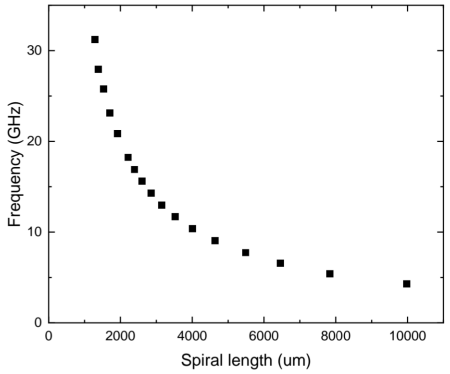

Fig. 2. The frequency ependence of the S_{11} parameter of a spiral EPR microresonator placed inside the dielectric resonator.

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