Design and experiment of a microwave cavity resonator for the imaging of microwave properties

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We investigated the capability of a cavity resonator to obtain the mapping of the microwave conductivity for the strongly correlated materials showing the phase separation near the metal-insulator transition. As shown in Figs. 1(a) and 1(b), a metallic tip mounted on a rod along a cylindrical axis (z axis) of the cavity resonator concentrates the microwave electric field, $E_{\omega}$, operated at TM$_{010}$ mode on a point of a sample inserted into the cavity [1]. Thus, by moving the sample on a plane perpendicular to the z axis, the local microwave properties of the sample can be measured as a function of the location on the sample. Experimental results which were obtained at room temperature by using a home-made reference sample strongly suggest that the conductive or dielectric part in the reference sample can be clearly detected by the change of the resonance frequency, as shown in Fig. 1(c).


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Fig.1 (a) Schematic of the microwave cavity resonator. (b) Numerical results: the distribution of the magnitude of $E_{\omega}$ along the z-axis. (c) Experimental results: the resonance frequency surface plots of a reference sample which was prepared by stacking aluminum (0.11 μm thick) and glass (0.15 μm thick) plates.