

Uniaxial Stress System for 35 GHz EPR and ENDOR Experiments*

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WE would like to describe a 35 GHz microwave cavity, presently in use at our laboratory,¹ suitable for electron paramagnetic resonance (EPR) and/or electron-nuclear double resonance (ENDOR) experiments under uniaxial stress.

The cylindrical cavity, resonating in a TE_{011} mode, has a loaded Q of 5000 and is coupled to the waveguide through a 3 mm diam iris at the side wall. A proper matching is accomplished with a variable short circuit driven from the cryostat head.

The main body of the cavity arrangement (see Fig. 1), made of 4 mm thick brass, holds a quadrupolar distribution for the field modulation coils² and has the necessary mechanical strength for uniaxial stress experiments.

The longitudinal cuts of the field modulation coils holder and proper insulation of the cavity bottom allow

for a Q of 12 at 100 kHz in our arrangement; ample field modulation can be obtained in this way. The field modulation coils are made to fit the holder holes (10 mm diam, 4 mm thick) and are fixed in place with GE lacquer 7031.³

The side wall of the cavity is made by electroplating with copper on an aluminum form, and is machined to its final shape in the form of a coil of 4.7 turns/cm and 0.25 mm thickness.⁴ This coil is covered with Epibond 100-A⁵ for mechanical rigidity, machined to 0.5 mm thickness. Its final dimensions are such that it will fit inside the main body of the cavity system.

After drilling the iris, the aluminum form is dissolved with a saturated solution of NaOH. In this way the microwave cavity side walls and rf coil are one; moreover, being an open structure a modulating magnetic field at 100 kHz is available at the sample with less than 10% loss. The rf coil has 5 turns in 13 mm diameter and shows an inductance of 0.2 μ H.

The uniaxial stress is applied by loading a platform (on top of the cryostat head) connected to a guided stainless steel tube terminated in a quartz rod⁶ (2.5 mm diam) which is in contact with the sample as can be seen in the figure.

We have operated this system successfully with loads up to 10³ kg/cm² without noticeable deformation and at different temperatures ranging from 360 K down to 1.3 K; no special care has to be taken in cooling the over-all system.

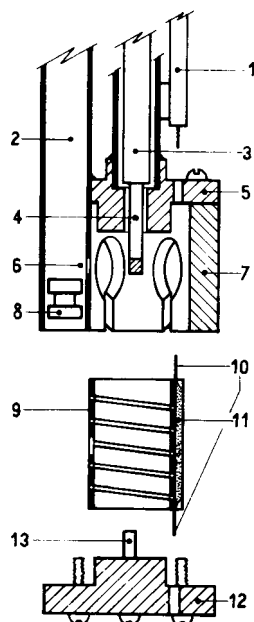


FIG. 1. Assembly of 35 GHz cavity. Main body: 1—rf coaxial, 2—stainless steel waveguide, 3—stainless steel loading tube, 4—quartz rod and sample, 5—cavity top, 6—coupling iris, 7—field modulation coils holder, 8—variable short circuit, 9—side walls and rf coil, 10—to rf coaxial, 11—Epibond 100-A, 12—cavity bottom, 13—quartz rod support.

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¹ S. B. Oseroff, R. Calvo, and C. Fainstein, *Phys. Lett.* A32, 393 (1970).

² G. Feher (private communication).

³ General Electric, Schenectady 6, N. Y.

⁴ A. R. Cook, L. M. Matarrese, and J. S. Wells, *Rev. Sci. Instrum.* 35, 114 (1964).

⁵ Epibond 100-A, Furane Plastics Inc., 4516 Brazil St., Los Angeles, Calif.

⁶ Z. Sroubeck, M. Tachiki, P. Zimmermann, and R. Orbach, *Phys. Rev.* 165, 435 (1968).