TEST OF A 5-CELL DAW CAVITY

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Abstract A 5-cell 500 MHz DAW cavity has been constructed and measured. After various low power tests including those for a tuner and an input coupler, a high power test of up to CW 55 KW has been performed. The result shows that a shunt impedance higher than 32 MΩ/m would be possible in 12-cell cavities[1] for TRISTAN AR.

The cavity is shown in Fig. 1. The cylinder wall is made by rolling an iron (SS-41) plate of 80 mm thick and by machining. Washers are made of SUS-304. All components are copper plated by about 40 μm in Cu-cyanide bath. The calculation with SUPERFISH gives 8.6×10^4 and 410 Ω/m to Q and R/Q, respectively, for the accelerating (π) mode. The calculated and the measured dispersion curves[2] are shown in Fig. 2. The measured R/Q for the accelerating mode coincides well with the calculated value, while the Q value is 65 %. The degradation is due to the stems and their contact to the cylinder wall (17 %), the contactors at the endplates (14 %) and the difference of the conductance of the ideal copper and the plated copper (9 %). The tuner gives a frequency change of -500 KHz for a projection of 7 cm, but a further projection degrades both Q and R/Q. The coupling coefficient of the input coupler can be set at 2 with a 2 cm projection of the inner conductor without affecting Q and R/Q.

In the high power test, the outgassing from the cavity surface has been studied as well as the overall performance of the cavity. The progress of the input power is shown in Fig. 3. The maximum input power attained was 55 KW, which corresponds to an accelerating field of 0.9 MV/m. In this measurement, rubber gaskets were used for every vacuum seal. The base pressure was 4×10^{-6} Torr before the aging and finally it has become 8×10^{-7} Torr. The integrated amount of desorbed N_2-equivalent molecules during the aging is shown in Fig. 4 as a function of the integrated RF power. An example of the mass spectrum of the outgas is given in Fig. 5. The main components were H_2, H_2O, CO and some hydrocarbons. These features shown in Fig. 4 and 5 are almost the same as those typically seen in argon glow discharge cleaning procedures for the conventional vacuum materials (Aℓ and SUS) and no singular features of the plated copper could be seen.

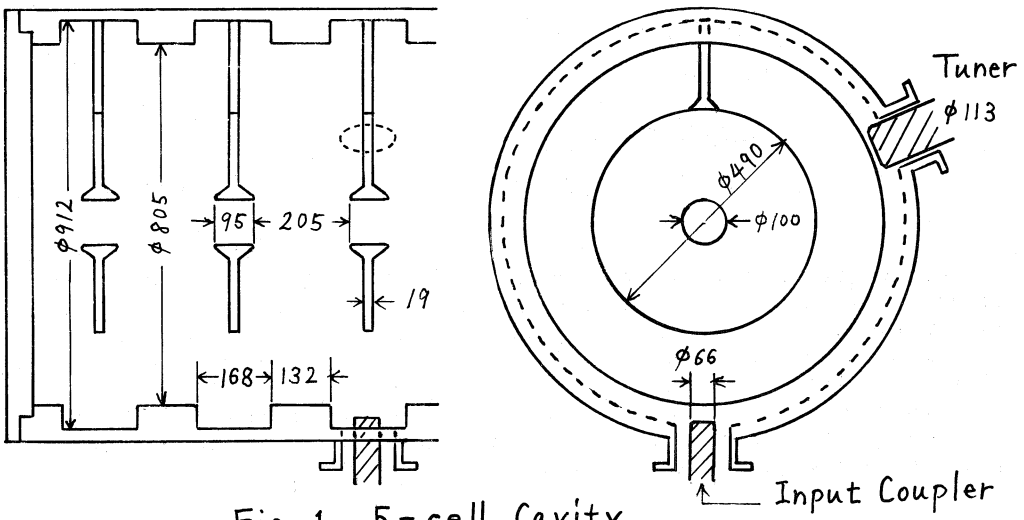
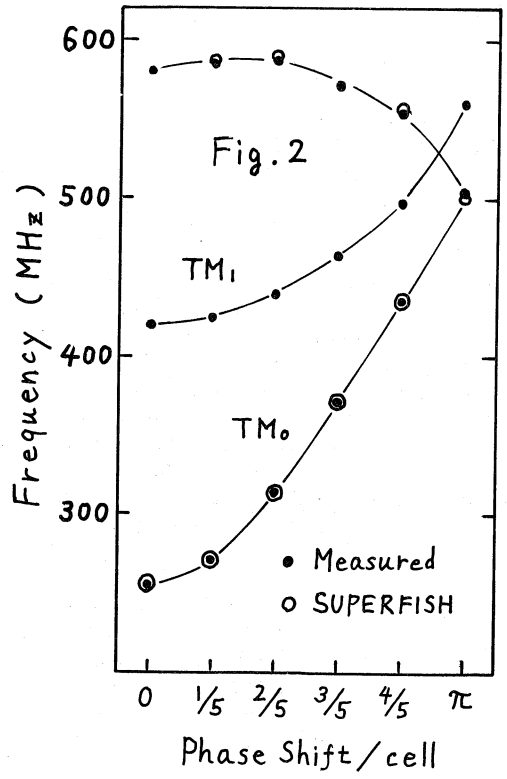
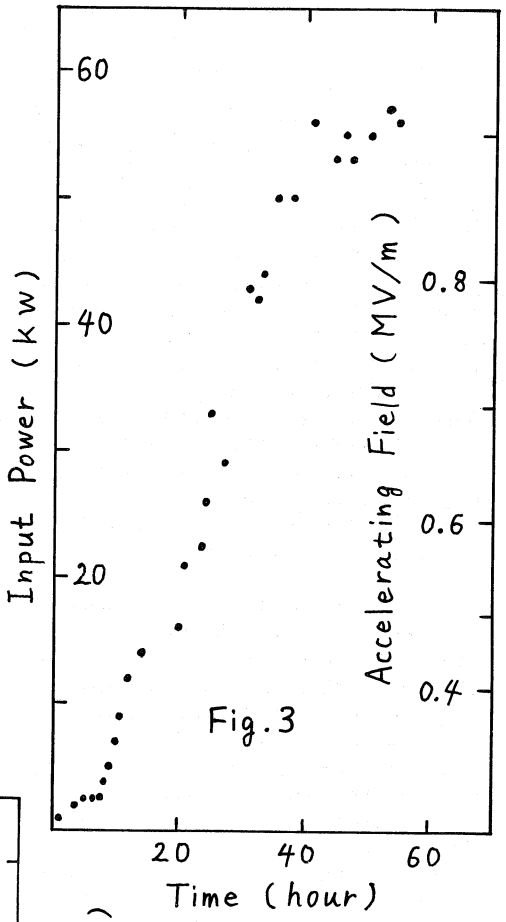
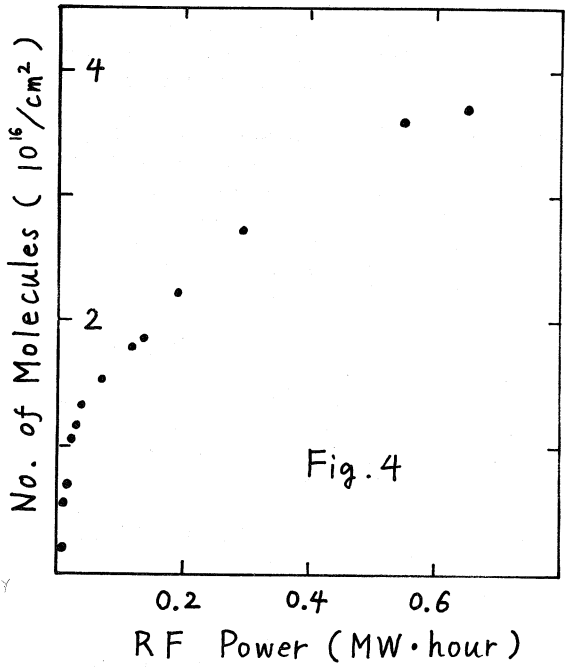


Fig. 1 5-cell Cavity







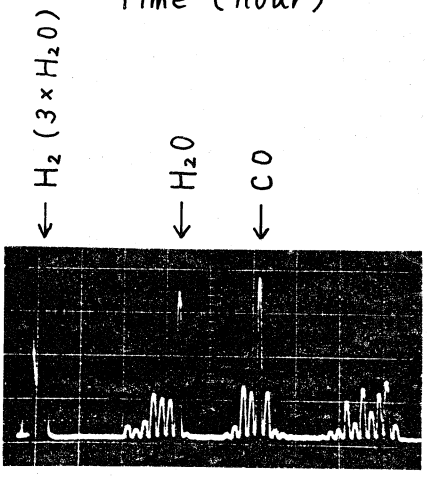


Fig. 5 Mass Spectrum

References
1) ABRIDGED DESCRIPTION OF TRISTAN ELECTRON-POSITRON COLLIDING-BEAM MACHINE, KEK (1981).
2) S. Inagaki et al., This Symposium.