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Theory Experiment

**Infrared Measurements of the Synthetic Diamond Window of a
110 GHz High Power Gyrotron,*** Y.A. Gorelov, J. Lohr, *General Atomics* —

The extremely low absorption of radiation in the millimeter wave range by synthetic CVD diamond has attracted considerable interest from the gyrotron community in the use of this material for gyrotron output windows. However, in several cases the first operation of high power gyrotrons with diamond windows resulted in failure of the windows, apparently from thermal stresses in excess of those predicted. There has been evidence of formation of an absorbing surface layer during brazing in some cases. To investigate the actual power deposition in the windows under operational conditions, detailed and accurate infrared (IR) measurements of the window during operation of a MW class 110 GHz gyrotron at General Atomics were undertaken. This work confirmed theoretical predictions of the window temperature stabilization after a few seconds of pulse duration. No hot spots or unexpected overheating were found for pulses up to four seconds in duration at about 500 kW. The very low infrared emissivity of diamond and its high transmissivity required corrections to the raw data to be applied during initiation of the gyrotron pulse for approximately the first second. The camera viewed the window through a sapphire viewport and microwave cutoff screen, each of which had a strong effect on the infrared measurement. The transparency of the diamond window also permitted the copper internal structure of the gyrotron to contribute to the infrared signal. These factors were taken into account by an empirical calibration using similar elements in the laboratory.

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Prefer Poster Session
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