Results From an X-Band Coaxial Extended Length Cavity

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Abstract— Experiments and simulations demonstrate high-power microwave generation at 9 GHz in a coaxial geometry. The 9 cm diameter annular electron beam is propagated between inner and outer drift tube conductors, a configuration which increases the beam current and reduces the structure fields from existing high-power sources. Since the TEM mode of the coaxial guide reduces the quality factor of small-gap cavities, especially at high frequency, the interaction is provided by an extended length cavity loaded with dielectric. A single 16 cm cavity generates 200 MW of power from the 400 keV, 7 kA electron beam. Although the cavity can oscillate at a number of resonances, a single mode is selected with 10–30 kW of input power from a magnetron. A coupler samples 25 MW of the power from the interaction region, precisely measured using a single-shot calorimeter. Simulations indicate that the efficiency of the device is limited to 7% by saturation effects, and can be improved by reducing the length of the cavity.