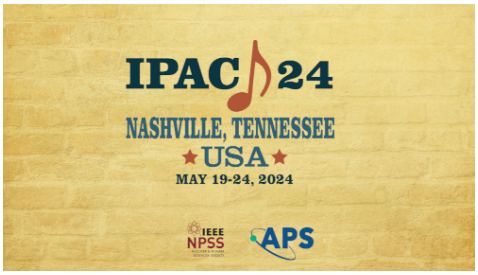

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Experimental testing of a ceramic enhanced accelerator cavity

Wednesday, 22 May 2024 16:00 (2 hours)

It is desirable to decrease the dimensions and power loss of accelerator components as much as possible when using accelerated charged particle beams on a rocket or satellite for ionospheric and magnetospheric research applications. We present the experimental results of a radiofrequency (RF) pillbox cavity loaded with a low-loss, high-permittivity ceramic placed concentrically within the cavity. We use high-electron mobility transistors (HEMTs) to power the RF at a frequency of 5.712 GHz. At this frequency, the cavity operates at a TM020 mode. The ceramic enhances the cavity's accelerating field confined within the scope of the ceramic insertion, increasing the shunt impedance, and improving the power coupling from the RF to the electron beam with the same gradient as a conventional TM010 mode cavity. Moreover, because the power coupling to the beam is improved, we were able to reduce the longitudinal dimension of the cavity compared to the conventional cavity. We show that the cavity accelerated the beam by approximately 12 keV. We also show that the cavity and ceramic can survive a flight to space by conducting vibration and shock tests that replicate the rocket launch environment.

Footnotes

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