Abstract Submitted
for the DPP10 Meeting of
The American Physical Society

Overmoded Dielectric Photonic Crystal Cavities for High-Power Microwave Applications ALAN COOK, BRIAN MUNROE, MICHAEL SHAPIRO, RICHARD TEMKIN, Plasma Science and Fusion Center, MIT — Photonic crystal structures are attractive for use in high-power microwave applications. Experiments have demonstrated use of cavities based on metallic lattices for millimeter wave/THz generation and high-gradient particle acceleration. Due to unique dispersion properties and the large number of materials available, dielectric lattices are particularly flexible for engineering of frequency band gaps; for example, they allow the design of overmoded cavities that have no lower-order mode competition. The use of such oversized cavities offers critical advantages for experiments at high frequencies, addressing key issues such as pulsed heating and parasitic higher-order mode (HOM) excitation. We present a specific design of an accelerator cavity operating in a TM_{02}-like mode at 17 GHz, formed by a 2D dielectric lattice between metal plates. The use of dielectric rods reduces magnetic pulsed heating on the inner rods, which has been shown to cause breakdown in metal-rod structures. Wakefield simulations show greatly reduced HOM excitation relative to a conventional pillbox cavity. We discuss high-power testing at 17 GHz at MIT and future topics of study, including 3D photonic crystal microwave devices, exotic dielectric materials, and combined metal and dielectric lattices.

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Date submitted: 16 Jul 2010 Electronic form version 1.4