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**Oversized 250 GHz Traveling Wave Tube with a Photonic Band-Gap Structure**[1] GUY ROSENZWEIG, MICHAEL A. SHAPIRO, RICHARD J. TEMKIN, Massachusetts Inst of Tech-MIT — The challenge in manufacturing traveling wave tubes (TWTs) at high frequencies is that the sizes of the structures scale with, and are much smaller than, the wavelength. We have designed and are building a 250 GHz TWT that uses an oversized structure to overcome fabrication and power handling issues that result from the small dimensions. Using a photonic band-gap (PBG) structure, we succeeded to design the TWT with a beam tunnel diameter of 0.72 mm. The circuit consists of metal plates with the beam tunnel drilled down their center. Twelve posts are protruding on one side of each plate in a triangular array and corresponding sockets are drilled on the other side. The posts of each plate are inserted into the sockets of an adjacent plate, forming a PBG lattice. The vacuum spacing between adjacent plates forms the PBG cavity. The full structure is a series of PBG coupled cavities, with microwave power coupling through the beam tunnel. The PBG lattice provides confinement of microwave power in each of the cavities and can be tuned to give the right amount of diffraction per cavity so that no sever is needed to suppress oscillations in the operating mode. CST PIC simulations predict over 38 dB gain with 67 W peak power, using a 30 kV, 310 mA electron beam, 0.6 mm in diameter.

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