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Abstract: The THz frequency range represents a true challenge for designers, fabrication technologies and characterization systems. So far, huge technological obstacles have prohibited any system realization different from laboratory one. Furthermore, most of the applications in the THz frequency range require a level of power not achievable by optoelectronic devices at room temperature or by solid-state technology. The recent availability of three-dimensional simulators and high aspect ratio micro-fabrication techniques has stimulated a class of vacuum electron devices operating in the THz regime, to get a level of output power to enable applications at these frequencies. The OPTHER (Optically driven THz amplifier) project, funded by the European Community, is on the road to realize the first 1 *THz* vacuum tube amplifier. Technology at the state of the art has been used for the realization of the parts with dimensions supporting THz frequencies. A backward wave amplifier configuration is chosen to make the parts realizable. A carbon nanotube cold cathode has been considered for electron generation. A thermionic micro electron gun is designed to test the tube. A novel slow-wave structure (SWS), the double corrugated rectangular waveguide, is devised to support a cylindrical electron beam and to guarantee high interaction impedance with limited losses. Both LIGA and UV SU-8 photolithography have been tested to realize the SWS.

Keywords: Terahertz, Carbon nanotube, Micromachining, LIGA, Vacuum electron device, Backward wave amplifier