

UTC-PD Integration for Submillimetre-wave Generation

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Abstract: Because of the inherent difficulty to generate power in the frequency range 0.1-10 THz, the term ‘THz-gap’ has been coined. Among a number of MW/THz generation techniques, the photomixer based sources hold high potential offering wide tunability and decent amounts of output power. The photomixing technique relies on the nonlinear mixing of two closely spaced laser wavelengths generating a beat oscillation at the difference frequency. In recent years, there has been an increasing interest in the Uni-Travelling-Carrier PhotoDiode (UTC-PD) [1] for photomixing, photo receivers, MW/THz-wave generation, fibre-optic communication systems, and wireless communications. UTC-PDs have become very promising by demonstrating output powers of 20 mW at 100 GHz [1] and 25 μ W at 0.9 THz [2].

Our ongoing research work concentrates on extending the previously accomplished UTC-PD fabrication and modelling techniques to \sim 300 GHz and above. We have already fabricated and characterised UTC-PDs intended for millimetre-wave generation. Several integrated antenna-detector circuits have been designed and characterised. Fig.1 (a) shows the SEM of a fabricated UTC-PD. Furthermore, in order to understand the device behaviour and its dependence on various factors, we have developed an accurate device model [3] implementing hydrodynamic transport model. The model has also enabled us to design and optimise the device for any specific application and target frequency [4].

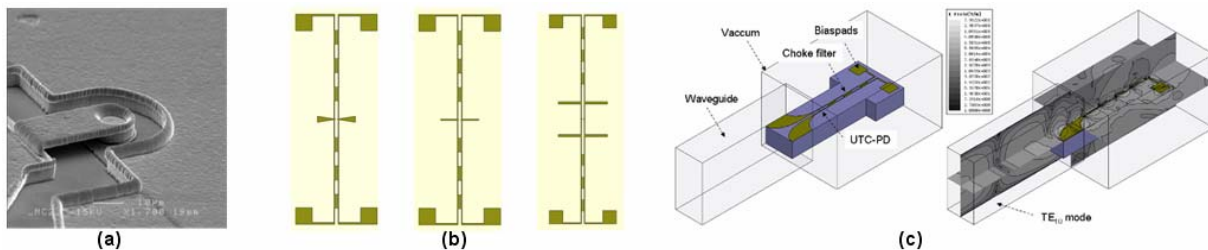


Fig. 1. (a) SEM of a fabricated UTC-PD (b) antenna integrated UTC-PDs, and (c) waveguide integrated UTC-PDs.

The current research-focus encompasses different integration approaches, and the construction of various antenna-integrated circuits and waveguide blocks that can be used as millimetre-wave (300 GHz and above) generator for local-oscillator and free-space applications. Fig. 1 (b-c) shows several antenna integrated UTC-PDs and an example of the waveguide integrated UTC-PD. The designs of those blocks and integrated circuits, their fabrication and characterisation results will be presented.

REFERENCES

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