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A new structural approach for uniform sub-micrometer anode metallization of planar THz Schottky components

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Abstract

This paper presents the evaluation of a Schottky contact technology based on electrochemical metal deposition. The results of a long-term systematic investigation and optimization of the anode formation process to improve the yield and performance of Schottky-based GaAs mixer diodes are detailed. Surface preparation prior to the Schottky-metal deposition and anode metallization as previously optimized for whisker-contacted diodes are successfully transferred to the fabrication of planar structures. This uses an auxiliary honeycomb array of anode-like structures called ‘dummy anodes’, which are processed simultaneously with the real anodes and then removed in the later technological processes. Consequently, the scattering of planar diodes electrical parameters is significantly reduced and the yield of the fabrication process increases from about 5% up to about 50%. Very good dc characteristics such as series resistance (Rs) below 8 Ω, ideality factor (η) below 1.2 and saturation current (Isat) of the order of 10−17A are achieved for the anode diameter as small as 1 μm. An excellent IF-noise figure of 250 K at 4.8 GHz up to 280 K at 2.1 GHz with current bias up to 3 mA is obtained for

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non-cooled THz mixer planar diodes. The use of this technological approach has enabled the extraction of statistically significant data which have been used to characterize the criticality of each step of the fabrication process on the device performance.