FEATURES OF NANOSECONDS AND PICOSECONDS LASER ABLATION FOR MICROFABRICATION OF PLANAR SLOW-WAVE STRUCTURES FOR MILLIMETER-BAND LOW-VOLTAGE TUBES WITH SHEET ELECTRON BEAM

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ABSTRACT

Travelling-wave tubes (TWTs), as well as other vacuum electron devices operating at millimeter-wave and submillimeter-wave frequencies, are of great interest due to its significant potential in medical imaging, ultra high-data-rate telecommunication, and etc. Conventional fabrication techniques are inadequate at these frequencies and microfabrication technology is a real practical alternative [1]. Slow-wave structure (SWS) is the key part of TWTs. Planar SWSs provide large slow-wave factor and low operation voltage [2]. Earlier we have proposed an original approach for microstrip meander-line slow-wave structure (MML SWS) microfabrication based on the nanoseconds laser ablation [3]. In this work, we consider and compare the features of utilizing the nanoseconds and picoseconds laser ablation for V-band, W-band, and D-band MML SWS microfabrication. We have carried out a detailed comparison of the SEM, optical and profilometry studies of SWS samples fabricated with help of nanoseconds and picoseconds laser ablation. It was shown that the mode of nanoseconds laser ablation requires post-processing of the fabricated structures. Profilometry studies of microfabricated SWS samples have shown that the dimensions of trash from the nanoseconds ablation process could achieve several microns while trash from the picoseconds ablation process does not exceed a hundred nanometers. In the future, we are going to utilize the femtoseconds laser ablation for MML SWS microfabrication.

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References

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