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Influence of pulse energy on machining characteristics in laser induced plasma micro-machining

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ABSTRACT

This work investigates the influence of pulse energy on machining characteristics using a 10 picosecond laser during Laser induced plasma micromachining (LIPMM) process. An axisymmetric model combining the effects of cascade, multiphoton ionization, and recombination and diffusion losses was developed to simulate the spatial and temporal plasma profiles at various pulse energies in distilled water. Thereafter, micro-channels with the corresponding pulse energies were created on stainless steel using LIPMM, and the plasma focusing process, depth and width of the machined channels were investigated. It was found that pulse energy had a negligible effect on the variation of the focusing distance during the LIPMM focusing process. The simulations and experimental geometric features showed similar qualitative trends with the increasing pulse energy at the plasma's focal plane. However, the pulse energy had a significant influence on the machined depth, but a much lesser influence on the machined width.

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