Femtosecond laser helical drilling of nickel-base single-crystal super-alloy: Effect of machining parameters on geometrical characteristics of micro-holes

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**ABSTRACT**

Laser micro-hole processing has been widely used in industry. Many laser processing parameters can affect the processing results. The relationship between the geometrical shapes of micro-holes and the laser processing parameters has not been determined accurately. In this paper, experiments on the femtosecond laser drilling of the nickel-base single-crystal super-alloy (DD6) materials were conducted to determine the relationship between the parameters, such as the laser single-pulse energy, rotation rate, and downward focus rate, and the geometrical characteristics of the micro-holes, such as the diameter, and roundness. A group of orthogonal experiments were conducted to determine the effects of the comprehensive influencing factors on the geometrical characteristics of the micro-holes. After the experiments were conducted and analysed, the experimental results were modelled by a backpropagation neural network, and the mapping relationship between the laser parameters and the geometrical morphologies of the micro-holes was constructed. The model established by the backpropagation neural network could obtain accurate prediction results, and the predictions of the diameters of the micro-holes were better than those of the roundness.

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**References**


