Effect of laser micro-drilling parameters on hole geometry and hole formation of thin sheet SS304

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ABSTRACT

The recent advances in manufacturing technology have led to the development of miniature products in the field of automobiles, aerospace, and robotics. Laser micro-drilling has developed as a potential substitute over conventional machining due to the advantages of operational precision, reduced operational costs, and a high-speed production rate. This process involves high power intensity from the laser to break down the bond between molecules of the workpiece and hence form a hole on the workpiece. This project aims to study the effect of laser power on the drilled hole geometry and to analyse the mechanism of the hole formation during laser micro-drilling. The material used in this project is SS304 sheet metal. The holes' geometry and hole formation will be analysed by using an optical microscope. The size of the hole diameter for each power is almost the same in the range of 101.669–102.978 µm for the frontside. Meanwhile, the diameter of the backside hole increases from 64.343 µm to 88.852 µm at 15 W to 21 W of laser power respectively. For hole formation, the more material is ablated as the ablation process advances. As a result, the removal area from the micro-drilled hole grows from 3577.852 to 6516.237 m^2. The shape of the hole is irregular due to the uneven power distribution of the laser towards the SS304 sheet metal when it undergoes an ablation process.

KEYWORDS

Hole formation; Hole geometry; Laser drilling; Laser power; Micro-drilling

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