

Laser drilling of alumina ceramics using solid state Nd:YAG laser and QCW fiber laser: Effect of process parameters on the hole geometry

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ABSTRACT

Nowadays a lot of lasers working at different parameters could be used for machining of a wide spectrum of materials. One of these materials is alumina ceramic as it is hard to machine using conventional methods due to high hardness and brittleness. In this paper the percussion drilling of alumina ceramics was performed by Nd:YAG laser and quasi-continuous-wave fiber laser. Effects of laser wavelength, pulse energy, pulse length and number of pulses were examined and the comparison of produced holes geometry was reported. The results show that it is possible to control the holes dimensions by changing lasers and parameters. Fiber laser provides generation of narrower holes due to its small spot and better beam quality together with high power densities. Shorter pulses 0.5 ms, high peak power 1 kW and energy density around 10 kJ/cm² are satisfactory for drilling, as they assured good holes circularity and less amount of melt. For Nd:YAG laser it was found that both entrance and exit holes diameters go up proportionally with the pulse length and pulse energy. The optimum parameters for this laser were pulse length 1 ms as good circularity and less amount of dross was obtained, and energy densities around 1 kJ/cm² leading to formation of hole with better quality. Moreover, higher number of pulses improves holes circularity.

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