High Average Power Pulsed Fibre Lasers for High-Quality Engraving

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Laser micromachining processes, such as laser engraving, are increasingly being exploited in industry in preference to conventional mechanical machining techniques such as milling and turning. The main advantages of laser processes are to their high precision, excellent finish quality and the avoidance of tool wear. Laser engraving, using nanosecond pulsed fibre lasers is used for product identification and has extensive use in the automotive, aerospace, electronics and jewellery industries.

Technological advances in industrial nanosecond pulsed lasers have provided higher average power systems that can be used to increase the throughput of laser micromachining processes. However, with some processes, such as engraving, it is necessary to understand the impact of the higher average power on the material removal mechanisms due to increased thermal effects and hence re-optimise process parameters to provide the required quality. In this presentation, we investigate high average power nanosecond laser processes to establish the material removal mechanisms and, based on that, propose combinations of process parameters capable of providing high-quality stainless steel, aluminium and brass engravings, using SPI's current pulsed 100W fibre laser.

A range of different laser beam scanning modes and engraving strategies have been investigated. We report the influence of laser parameter combinations on burr formation, the morphology of engraving, material removal rate, and surface roughness; and hence provide suitable laser parameters and laser beam scanning strategies for high throughput and high-quality laser engraving.