

Laser Drilling of Thermal Barrier Coated Nickel Alloy

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Milisecond laser drilling is the current state-of-the-art for producing acute angle film-cooling holes over aero-engines and gas turbine components. After the laser drilling process, most of these components are covered with thermal barrier coating (TBC), to maintain the temperature of the component to an acceptable level. The preferred manufacturing method would be to laser drill the cooling holes after TBC coating, but is not practiced in manufacturing industries due to the issues associated with coating delamination. The issue of thermal barrier coating delamination during laser drilling of coated material is well known within the scientific community and has been a topic of research for the last thirty years [1, 2], but without any significant success on controlling the TBC delamination.

The recent introduction of milisecond pulse quasi-CW fibre lasers is having a significant impact on the laser drilling of metals and alloys. This paper investigates the fundamental aspects of millisecond-pulsed-quasi-CW-fibre laser drilling of angular holes over TBC coated aerospace nickel superalloy. The main investigation concentrates on understanding the quasi-CW-fibre laser parameters to control the TBC delamination. Apart from the investigation on traditional percussion and trepanning laser-drilling of acute angle holes over coated component, a new method of drilling called "laser drilling post laser scribing" was evaluated, to achieve delamination free milisecond laser drilling.

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