

Abstract

Laser processing, as a time-dependent energy beam manufacturing method, has been drastically demanded recently in many industry sectors such as aerospace, automotive, biomedical, etc. However, on one hand, the scientific basis for designing energy beam scanning strategies (e.g., beam scanning speed, beam path, beam power) still relies on trial and error approaches (i.e. experimental/simulation of predefined beam trajectories) followed by the evaluation of process outcomes (e.g. structural/metallurgical properties of the built parts); on the other hand, while the surface integrity can significantly influence the functional performance of laser manufactured component, understanding the laser-materials interaction mechanism is of importance to reduce the surface defects during the laser processing.

This presentation will focus on recent developments in advanced laser materials processing technologies at the University of Nottingham (UoN). Firstly, a novel spatially and temporally controlled laser beam heat placement model developed at University of Nottingham will be introduced, whereby an inverse problem has been employed to optimise the laser power together with either laser path or laser speed to achieve a particular temperature distribution that generates prescribed three-dimensional heat features with minimal error. Then specific applications of laser beam processing techniques, e.g., laser assisted machining, waterjet-guided laser processing, laser surface engineering that have been successfully applied in many industries from recent research projects at UoN will be presented. This will also include the research on laser processing of different materials such as superalloys, thermal barrier coatings, biomaterials with in-depth understanding of their laser-materials interaction and surface generation mechanisms.

Biography

Dr. Zhirong Liao finished his PhD study at Harbin Institute of Technology, China and joined the Rolls-Royce UTC in Manufacturing and On-Wing Technology, University of Nottingham, as a research fellow in 2016. He was awarded a Nottingham Research Fellowship and started his independent academic career at the University of Nottingham in 2019, and was promoted to Associate Professor in 2022. He is also a member of the Propulsion Futures Beacon of Excellence at the University of Nottingham. His research area mainly



focuses on conventional and nonconventional manufacturing technologies with conscious of materials science. He is an Associate Member of the International Academy for Production Engineering (CIRP), Secretary of CIRP UK, Member of Institution of Mechanical Engineers (IMechE), Member of the International Society for Nanomanufacturing (ISNM). Dr. Zhirong Liao is also the Associate Editor of the International Journal of Machine Tools and Manufacture, Guest Editor of the Chinese Journal of Mechanical Engineering. Dr. Zhirong Liao has closely work with industry, e.g., Rolls-Royce, GKN Aerospace, SECO Tools, Smith-Nephew, etc., to develop advanced manufacturing technologies to solve the industrial needs from different sectors such as aerospace and biomedical.