Extreme High-Speed Laser Application (EHLA) and its Emerging Applications

Josh Barras[1], Carl Hauser[1], Yingwei Wu[1], Jhonattan Gutjahr[1]

[1]TWI Ltd, Wallis Way, Catcliffe, Rotherham, S60 5TZ, UK

EHLA is a high-speed evolution of the laser cladding/ laser beam – directed energy deposition process, with a modified powder laser gas jet focus. In the EHLA process, the powder (along with a carrier gas), is fed by a coaxial nozzle, which is coincident with a focused laser beam around a millimetre above the substrate. This offset allows the powder to be melted prior to reaching the substrate, absorbing a significant portion of the laser energy and thus reducing the heat input into the substrate, resulting in significantly reduced dilution and heat affected zone size. The pre-melting of the powder removes the dependency of generating a sufficient surface melt pool, which allows this technology to reach deposition speeds of up to several hundred metres per minute.

Enhancement to the corrosion and/or wear resistance of a material can extend the service life of a component significantly. A cost-effective solution is the application of coatings that protect the underlying materials from the corrosive environments, thus extending the service life. The development of enhanced coating technologies is therefore essential to meet industrial demand for better performing, longer lasting coatings, as well as lowering costs and improving production rates, all whilst aligning to evolving legislation. The extreme high-speed laser application (EHLA) technology is being studied as an alternative to traditional metallic coatings technologies. More recently, EHLA has been gaining traction and promising results for the repair of high-performance and extreme environment components.

An overview of results is presented for various application case developments, including aerospace repair, coatings for preventing hydrogen embrittlement, coatings to reduce emissions from brake discs, and high-speed additive manufacturing.