Extreme High-speed Laser Application (EHLA); a step change in coating technology

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This keynote is a review of the EHLA process for the application of coatings. The hard facing of a components surface is a common industrial process used to enhance wear and corrosion resistance. It can be applied using a range of different methods and materials; depending on a number of different factors such as substrate size, complexity and access to a surface, coating thickness, performance, and cost. However, there is always a trade-off between speed of deposition and level of adhesion (which is directly proportional to the quality of coating). For example, a thermal sprayed coating has high coverage rate (125 cm^2/min) but the bonding mechanism can be weak (mechanical interlocking with some diffusion) leading to poorer performance for the harsher environments. By contrast, laser metal deposition (LMD) uses a focused laser beam to fully fuse powder to a substrate, giving a vastly superior coating (>99.9% dense, metallurgically fused and defect free), but applied at a much slower rate (25 cm^2/min).

In 2017, the extreme high-speed laser application (EHLA) process was developed; evolved from LMD and is capable of applying fully fused metallic coatings with a maximum coverage rate of 250 cm^2/min (i.e. >10x faster); and brings with it great potential for new capability. High speed becomes possible by melting powder prior to reaching the substrate, thereby reducing the time/energy that would otherwise be required to melt the substrate and then introduce cold powder. EHLA is also capable of producing thinner coatings than conventional LMD due to very little dilution between substrate and deposited material (10µm-300µm rather than >500 µm). The characteristics of a low dilution also opens up the technology to develop coatings with dissimilar materials.