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Laser shock peening as a post processing technique for cold sprayed coatings

Abstract
Cold spraying has emerged as a promising solid-state deposition technique for repair and additive manufacturing of structural components. However, cold sprayed coatings often suffer from high porosity, weak inter-particle bonding and tensile residual stresses that compromise its reliability for practical applications. Laser shock peening (LSP), traditionally applied for fatigue life enhancement, offers a novel approach to enhance integrity of cold sprayed coating by employing controlled, high-pressure laser-induced shock waves to densify the microstructure and induce beneficial compressive residual stresses. This presentation will showcase some case studies on the application of LSP to various cold sprayed coatings. The influence of various laser peening systems, including conventional high-power nanosecond laser, newly developed ultracompact low power microchip nanosecond laser and femtosecond laser system, on coating integrity will be shared. Our findings reveal that LSP can produce a spectrum of effects, ranging from microstructural refinement and densification to even cracking and delamination depending on the shock wave intensity and coating microstructure. The talk will further explore the underlying shock–microstructure interactions and outline future directions for integrating peening into cold spray processing as a pathway towards robust, high performance surface engineering solution.

Biography
Dr. Niroj Maharjan is a research fellow at Swinburne University of Technology specializing in laser-based surface engineering and advanced coating technologies. His work spans laser shock peening, additive manufacturing, plasma spraying and cold spraying, with an emphasis on improving durability and performance of critical components. With a focus on industry-driven applied research, he has led collaborations with companies such as Rolls-Royce, Halliburton, Defence Science and Technology Group, Hypersonix and voestalpine, delivering customized surface engineering solutions for practical applications. He has published over 35 peer-reviewed papers and is a professional chartered engineer with Engineers Australia and a founding member of the International Society for Intelligent Manufacturing (ISfIM).