**Development of a Portable Laser Metal Deposition System**

**for On-site Metal Repair Application**

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A Portable Laser Metal Deposition (LMD) System has been developed for on-site metal repair applications. Laser metal deposition metal repair studies on Rail steel with Stellite 6 powder will be presented for on-site rail repair operations on a simulated rail track platform application. The Portable Laser Metal Deposition System (PLMDS) was developed as a modular system with deployable lifting cage-trolley for the robot laser assisted LMD system, utility trolley for water chiller, argon gas, power generator. Laser Metal Deposition (LMD) process using Stellite 6 powder deposited on rail steel substrate was investigated for metallurgical, wear and shear properties. Microstructural analysis and microhardness measurements on cross-sectioned samples extracted from Stellite 6 clad on rail steel specimens will be reported. Wear testing was conducted using a laboratory ball-on-disc tribometer tester for rail steel and Stellite 6 cladded specimens to measure the wear coefficients for Stellite 6 and rail steel fitted to Archard’s wear model. Shear testing was conducted to measure the clad/substrate material interface as an indication of the metallurgical bond strength. The Metal Additive Manufacturing repair study on rail steel with Stellite 6 powder show that the hardness, wear resistance, and shear strength of the Stellite 6 clad material gave satisfactory results for rail steel repair and remanufacturing applications to rail steel components. The development of such a portable LMD system will provide the capability for on-site track repair maintenance operation in the future.

**Keywords**

Additive Manufacturing; Laser Metal Deposition; Metal Repair; Rail Steel; Stellite 6