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(57) Abstract :
Abstract The primary objective of this study is to enhance surface coating characteristics and reduce the dilution rate of AZ61 magnesium alloy coated with Stelcar alloy powder through laser cladding. A Taguchi (L16) orthogonal experimental design employed to analyze the effects of scanning speed, laser power, powder feed rate, and gas flow on wear volume, dilution rate and micro-hardness. Signal-to-noise ratios were calculated for each parameter to identify their individual effects on the responses. The findings indicated that powder feed rate predominantly influenced wear volume, accounting for 88.18% of its variation, while scanning speed has the highest influence on dilution rate (73.20%), and laser power significantly affected micro-hardness (84.60%). The optimized processing parameters were identified as a scanning speed of 11 mm/s, a laser power of 1.3 kW, a powder feed rate of 40 g/min, and a gas flow rate of 380 L/h. These parameters yielded a minimum wear volume of 0.8427 mm^3, a dilution rate of 18.21%, and a maximum micro-hardness of 678.07 HV. This study utilized grey relational analysis to determine the optimum processing parameters, which simultaneously reduced wear volume, minimized dilution rate and enhanced micro-hardness. Keywords: AZ61 magnesium alloy, Laser cladding, Stelcar alloy powder, Dilution, GRA

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