World Academy of Science, Engineering and Technology
International Journal of Materials and Metallurgical Engineering
Vol:18, No:06, 2024

Advancements in Laser Welding Process: A Comprehensive Model for Predictive Geometrical, Metallurgical, and Mechanical Characteristics

Authors : Seyedeh Fatemeh Nabavi, Hamid Dalir, Anooshiravan Farshidianfar

Abstract : Laser welding is pivotal in modern manufacturing, offering unmatched precision, speed, and efficiency. Its versatility in minimizing heat-affected zones, seamlessly joining dissimilar materials, and working with various metals makes it indispensable for crafting intricate automotive components. Integration into automated systems ensures consistent delivery of high-quality welds, thereby enhancing overall production efficiency. Noteworthy are the safety benefits of laser welding, including reduced fumes and consumable materials, which align with industry standards and environmental sustainability goals. As the automotive sector increasingly demands advanced materials and stringent safety and quality standards, laser welding emerges as a cornerstone technology. A comprehensive model encompassing thermal dynamic and characteristics models accurately predicts geometrical, metallurgical, and mechanical aspects of the laser beam welding process. Notably, Model 2 showcases exceptional accuracy, achieving remarkably low error rates in predicting primary and secondary dendrite arm spacing (PDAS and SDAS). These findings underscore the model's reliability and effectiveness, providing invaluable insights and predictive capabilities crucial for optimizing welding processes and ensuring superior productivity, efficiency, and quality in the automotive industry.

Keywords : laser welding process, geometrical characteristics, mechanical characteristics, metallurgical characteristics, comprehensive model, thermal dynamic
Conference Title : ICCM 2024 : International Conference on Composite Materials
Conference Location : Montreal, Canada
Conference Dates : June 13-14, 2024