Current research and development status of dissimilar materials laser welding of titanium and its alloys

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ABSTRACT

Since its inception, laser beam welding as a high-quality fusion joining process has ascertained itself as an established and state of art technology exhibiting tremendous growth in a broad range of industries. This article provides a current state of understanding and detailed review of laser welding of titanium (Ti) alloys with corresponding dissimilar counterparts including steel, aluminium, magnesium, nickel, niobium, copper, etc. Particular emphasis is placed on the influence of critical processing parameters on the metallurgical features, tensile strength, hardness variation, percentage elongation and residual stress. Process modifications to improve dissimilar laser weldability by virtue of techniques such as laser offsetting, split beam, welding-brazing, hybrid welding and materials modifications by means of the introduction of single or multiple interlayers, fillers and pre-cut grooves are exploited. Detailed and comprehensive investigations on the phenomena governing the formation and distribution of the intermetallic phase, material flow mechanisms, their relations with laser parameters and their corresponding impact on the microstructural, geometrical and mechanical aspects of the welds are thoroughly examined. The critical issues related to the evolution of defects and the corresponding remedial measures applied are explored and the characteristics of fracture features reported in the literature are summarised in thematic tables. The purpose of this review is tantamount to emphasise the benefits and the growing trend of laser welding of Ti alloys in the academic sector to better exploit the process in the industry so that the applications are explored to a greater extent.

KEYWORDS

Airport; Glare impact; PV potential; Site suitability; Solar

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