

OP 295

Fit-up tolerance in laser welding

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Fit-up tolerance is one of the most challenging aspects of laser and EB welding. The small heat source and highly concentrated energy in power beam processes result in localized heating and melting of the material, forming small volumes of liquid metal. This makes it difficult to accommodate any potential gaps. Additionally, material loss through vaporization and spatter, along with the lack of filler metal, exacerbates this problem.

In most applications, preparing surfaces to the level required by high-power beam processes is expensive. This often hinders the application of these high-productivity processes over more traditional arc-based welding processes.

This paper reviews the fundamentals of gap bridging in high-power laser welding. Aspects such as the addition of filler wire, the maximum volume of liquid that can be supported by the root, recoil pressure, and metal flow were investigated. Various experiments and numerical modelling were carried out under different processing conditions and welding positions to demonstrate how to maximize gap bridging capability. The outcomes show that the most important aspects, in order of priority, are sufficient supporting force at the root side, sufficient volume of liquid metal, and correct power distribution. Additionally, some experiments with innovative ways of adding filler metal are presented.