Modeling Of The Keyhole Asymmetry In Dissimilar Laser Welding

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Abstract

An auto-consistent multiphysical 3D model with strong coupling between Heat Transfer, Navier Stokes and ALE problems is proposed for the description of transient development of the keyhole and the melted zone in laser welding of metallic materials. It showed a satisfactory correspondence with experimental melt dimensions in case of standalone and dissimilar pulsed laser welds and allowed an adequate representation of free surface evolution, comprising the advanced stages of evaporative digging of the keyhole and further cooling collapse. The model was used for the comprehension of keyhole asymmetry in the dissimilar joints, on the example of butt joints welded by a pulsed laser. The asymmetry of the keyhole between the reference metal and the neighboring random metal was quantified using two parameters: a relative keyhole section and a relative root offset in the reference material. Both parameters were increasing with the vaporization temperature of the neighboring material. However, for highly reflective materials this increase was much slower.

Figures used in the abstract

Figure 1 : Thermal field in different Ti-containing dissimilar welds