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Study of the laser melting of pre-deposited intermetallic TiAl powder by comprehensive optical diagnostics

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Abstract

The objective of this study is to develop intermetallic TiAl coatings through the laser melting of Ti-48Al-2Cr-2Nb pre-deposited powder on Ti6Al4V substrate. The coating formation is studied inside an insulated box filled with a protective gas using a high-speed single-wave pyrometer, an IR-camera, and a high-speed CCD camera with pulsed laser illumination. The relationship between the IR-camera signal and the powder melted track width measured by microscopy was used to determine the signal level corresponding to the molten pool shape. The geometry of the molten pool and the heat affected zone *versus* processing parameters are analysed.

It is found that undesirable Al losses through its volumetric boiling prevent TiAl formation. By analysing the evolution of the pyrometer signal, it is possible to assess the size of the zone of the laser radiation transfer in the powder bed which is found larger than the length of the molten pool.

The process visualization has shown that the powder particles are melted and form relatively large size liquid droplets, 30 – 100 μm , that later on are integrated into the molten pool

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