

Microstructural evolution at the overlap zones of 12Cr martensitic stainless steel laser alloyed with TiC

D.I. Adebiji, A.P.I. Popoola, S.L. Pityana

Multiple track laser alloying is characterised by additional heat treatment and differences in the amount of powder deposited at the overlap regions. These result in different microstructural and phase evolution at these regions, which are not obtainable in the single tracks. X12CrNiMo steel has been laser alloyed with TiC using a 4.4 kW continuous wave (CW) Nd:YAG laser. The process parameters were first optimised after which they were kept constant for overlap ratios of 50% and 75%. The depths of the alloyed zone, the microstructural evolution, metallurgical structures and compositions are different for the 50% and 75% overlap. The 75% overlap sample has an alloying depth of 4233 μm (about two times that of the 50% overlap). The XRD of the 50% overlap sample reveals the presence of complex carbides, which are absent in that of the 75% overlap. Although both overlap samples have retained martensite, diffractographs show that the martensite of the 75% is richer in carbide. These are attributed to differences in powder catchment, heat build-up and depth of alloying.