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Laser cladding parameters evaluating of TGO NiCrAlY under Cooper and Inconel substrates for TBC anchoring applied to turbine vanes and rocket-engine chambers

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Space launch vehicles (SLV) and jet aircraft (JA) are propelled by liquid combustion systems; operating under extreme temperature (up 3000K) and pressure conditions. As a result, combustion chambers and vanes are susceptible to high thermal drag, contributing to its early wear. Despite the chambers are imbued with cooling channels and vanes are made with Inconel superalloys; its negatively impact both cost and payload capacity. Thus, thermal barriers coating (TBC) is an alternative. However, TBC ceramic still a technological challenge. Therefore, it is necessary a transition coating deposition; or thermal growth oxide (TGO) bonding layer. With this, allowing a smoother metal/ceramic thermal properties transition. In addition, ceramic anchoring by TGO oxide layer covalent bonding. According to the literature, laser cladding stands out for promoting metallurgical bonding between metallic substrates and coating powders. Thus, could promote anchoring between metallic NiCrAlY TGO and copper and Inconel substrates. In this context, this article aimed the laser cladding parameter determination applied to TGO nickel-based and NiCrAlY powders under Inconel and Cooper substrates. For this purpose, Copper and Inconel substrates (25mm diameter disks with a thickness of 4mm) and Nickel 99% (-0.01 ?m/+48?m, P/M Master-Melt) and NiCrAlY (-75 ?m/+45?m, NI-192-5 Praxair-Linde) powders were used. For laser cladding, was used a system composed by IPG Ytterbium laser (? = 1.07?m and maximum power "P" of 1500W) with a beam spot "bs" of 6mm and a top-hat headstock profiling. Where the coating powder was supplied by a AT-1210 Thermach powder feeder; with an Argonium cylinder, operating at a "vt" flow rate of 7 l/min. In addition, the laser headstock was carried by a Yaskawa CL25 robotic arm. With the depositions trajectories defined by RoboDk software programming; which controls the robotic arm. Initially, starting parameters were determined under copper substrates with Nickel-based powder. Where made line tracks and surface coatings (25X25mm with tracks overlapping, each other at an "Ov" ratio of 50%). Then, the obtained parameters of: P (W), velocity of beam scanning "vs" (mm/s) a powder feed rate "µ" (g/min); next depositions were carried out on Inconel and Cooper using NiCrAlY powder. The obtained samples cross-sections were evaluated by optical microscopy (OM) and scanning electron microscopy (SEM). Likewise, its elemental distribution was evaluated using energy-dispersive X-ray spectroscopy (EDS). The parameters process-chart for samples evolution was evaluated. The results showed optimum parameters of vs=7mm/s, P=1275 W and mi=4 g/min. With these parameters showing cross-sections with dense coatings with few flaws, both under copper and Inconel substrates. In addition, were confirmed TGO/substrate metallurgical bonding occurrence by EDS. Concluding that these parameters would allow alumina and yttria-treated zirconia for TBC on rocket-engines and turbine vanes.