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INFLUENCE OF ROTATIONAL SPEED IN THE FRICTION SURFACING OF TITANIUM GRADE 1 ON Ti-6Al-4V

Do Vale, N.L.(1); Urtiga Filho, S.L.(1); Fitseva, V.(2); Hanke, S.(2); Dos Santos, J.F.(2);
Universidade Federal de Pernambuco(1); Universidade Federal de Pernambuco(2); Helmholtz-Zentrum Geesthacht GmbH - Institute of Materials Research(3); Helmholtz-Zentrum Geesthacht GmbH - Institute of Materials Research(4); Helmholtz-Zentrum Geesthacht GmbH - Institute of Materials Research(5);

Nowadays an essential form of surface engineering is the Friction Surfacing (FS) technique. The Friction Surfacing concept was first patented as a metal coating process by Klopstock and Neelands, in 1941. Although only from 1986 the process has been used more frequently in the manufacturing industry. The layers deposited by this process has its importance based on the capability of extending the service life of various components by repairing worn parts, reducing wear and improving anticorrosion properties. Friction surfacing occurs in a solid state and is based on the plastic deformation of a metallic consumable rod. The required heat for the process is generated by friction and the bonding is achieved by an applied forging pressure. Many studies are found in the literature regarding the deposition of different materials by Friction Surfacing, however the majority are related to the deposition of steel and aluminium alloys. Therefore, although titanium is a more expensive material, it has interesting properties and has a wide range of applications, especially in the aircraft industry. In the present work, Titanium Grade 1 was deposited on a substrate of Ti-6Al-4V, with 2 mm thickness, by Friction Surfacing. The main process parameters are: rotational speed, deposition speed and axial force. The consumption rate control, instead of force control, has been implemented as an efficient mode for the deposition of Titanium Grade 1 coatings. Three values of rotational speed were selected, and the others parameters were kept constant, in order to evaluate the effects of the rotational speed in the coatings generated. The coatings were evaluated macroscopically by its geometry (thickness and width) and how deep is the heat affected zone in the substrate. Also, a microstructural analysis by optical microscopy and scanning electron microscopy was performed in the coatings. So, the main objective of this research is to investigate the effect of the rotational speed in the coating´s geometry and microstructural evolution. This investigation has shown that Titanium Grade 1 coatings can be successfully deposited onto a Ti-6Al-4V substrate by Friction Surfacing. Regarding the coating´s geometry, its thickness and width were influenced by the rotational speed, increasing with enhancing this speed. The substrate thickness was complete heat affected for all conditions studied. Furthermore, the homogeneity of the coating surface has been established to be a function of the rotational speed.