Finite Element analysis and neutron diffraction evaluation of residual stress in stellite coating by PTA process

A. Nady[1], A. Benmarouane[1], H. Bonnefoy[1], V. KloseK[2], M. H. Mathon[2], A. Lodini[1]

[1]UFR Sciences Exactes et Naturelles, LACM, B.P 1039, 51687 Reims Cedex 2, France

[2]Laboratoire Léon Brillouin, CEA Saclay, 91191 Gif sur Yvette, France

Abstract:

A grade 6 cobalt-based superalloy was coated on steel substrate by the Plasma Transferred Arc (PTA) method. The macrostructure and microstructure of the interface and of the co-based superalloy layers are studied. The superalloy grains are deformed during the cladding process.

At the interface, the superalloy grains elongate and tend to follow the geometry of the interface. Observation with a scanning microscope reveals zones of localised Affected Zone Thermal at the interface.

A numerical analysis has been carried out to simulate the PTA process deposition with physical conditions and mechanical properties using the Abaqus code. A simplified model based on energy conservation and wall functions is used to predict the process, solid shield and shroud on the temperature and the residual stress of the PTA technology at the surface of coating layer and the interface.

The results reveal that the residual stress obtained by the numerical simulation are in very good agreement with experimental results performed by the neutron diffraction.

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