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P. Cavaliere, A. Silvello, N. Cinca, H. Canales, S. Dosta, I. Garcia Cano, J.M. Guilemany

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Microstructural and fatigue behavior of Cold Sprayed Ni-based superalloys coatings

P. Cavaliere[a*], A. Silvello[a,b]

N. Cinca[b], H. Canales[b], S. Dosta[b], I. Garcia Cano[b], J.M. Guilemany[b]

[a]Department of Innovation Engineering, University of Salento, I-73100 Lecce, Italy

[b]Thermal Spray Centre, Department of Materials Science and Engineering, Universitat de Barcelona, C/ Martí i Franques 1, 08028, Barcelona, Spain

Abstract

In the present paper, the microstructural and mechanical properties of Ni based superalloys coatings, cold sprayed on C steel substrates, are analyzed. Different coatings were produced by varying the processing parameters (gas and temperature, pressure and spraying distance) in the ranges 700-850°C, 3.5-4MPa and 20-60 mm respectively. Optical microscopy was employed for the microstructural characterization and the porosity measurement of the produced coatings. Various experimental evidences underline the possibility of performing repairs through cold spray because of the good level of adhesion achievable by employing optimal processing parameters. In the present paper, the potential repair of cracked steel sheets by employing cold spray technology is presented. 60° and 90° V-type surface notches, machined on carbon steel panels, have been repaired by using Diamalloy cold sprayed powders. The microstructural behavior of the produced coatings was analyzed through optical and scanning electron microscopy. The mechanical properties of the coatings were evaluated through nanoindentation and adhesion tests. The fatigue properties of the coatings were analyzed, through bending tests, in order to evaluate the crack initiation and growth behavior in the coatings during cyclic loading. The K factor was quantified for the different notches geometry. In general, an increase in crack growth rate is recorded in those sheets with 60° V-type notch; crack growth rate also increases as the maximum load during test increases. The cracking mechanisms were studied through SEM observations after fatigue tests.

Keywords: Cold Spray; Ni-based superalloy; Processing parameters; Fatigue.

*Corresponding author: pasquale.cavaliere@unisalento.it