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Thermal Sprayed Coatings for Hot Corrosion Protection of Exhaust Valves in Naval Diesel Engines

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Abstract

Fuel used in diesel engines for naval propulsion contains high levels of impurities, principally vanadium and sulfates, that can react to form aggressive compounds, responsible for hot corrosion phenomena, leading to severe degradation of engine's components, especially exhaust valves. A protective coating is thus required to increase service life of the valves in the highly corrosive environment.

In this work five different thermal-sprayed metal-ceramic coatings are selected as potential candidates and their hot corrosion resistance is investigated and discussed in terms of microstructure evolution and hot corrosion kinetics. Four coatings were deposited by either HVOF or APS processes starting from commercial powders (Cr_3C_2-CoNiCrAlY, Cr_3C_2-self fusing alloy, Cr_3C_2-NiCrAlY, Cr_3C_2-NiCr), optimizing deposition parameters by DoE technique. The last composite coating was purposely designed including silica nanoparticles and ceramic fillers (mullite) in a NiCr matrix, and was deposited by HVOF.

Microstructural characteristics of each coating in the as-sprayed conditions were evaluated by measuring porosity and microhardness. Hot corrosion tests were performed on samples