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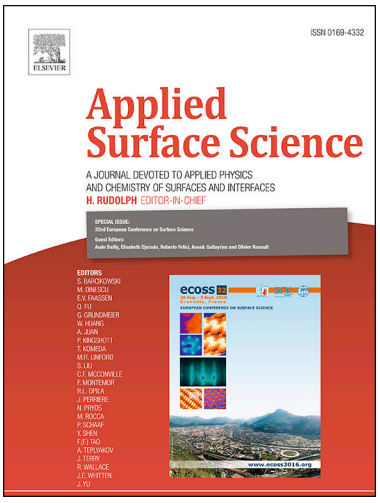

Full Length Article

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Post-spray modification of cold-sprayed Ni-Ti coatings by high-temperature vacuum annealing and friction stir processing

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Abstract

In this study, two post-spray treatments, i.e. high-temperature vacuum annealing (HTVA) and friction stir processing (FSP), were employed to modify the cold-sprayed (CS) Ni-Ti coatings, obtained from a mechanically blended powder. The phase transformation occurred at different HTVA temperatures, but with the formation of pores due to the Kirkendall effect. FSP proved to provide a new opportunity for the formation of intermetallic phases in the CSed Ni-Ti coating. A comparison of the microstructures, microhardness and tribological behaviors between the CSed and FSPed coatings, reveals that the microstructure of the modified Ni-Ti coating exhibits a mechanically alloyed layer with the in-situ synthesized Ni-Ti intermetallics, and no obvious defects are found. The microhardness of the improved layer is increased to 1003.5 ± 65.9 $HV_{0.1}$, which is about 4.5 times compared to the CSed coating (222.5 ± 6.6 $HV_{0.1}$). In addition, the mechanically alloyed layer by FSP contains multiplicate Ni-Ti intermetallic compounds, exhibiting better wear resistance than that of the CSed coating, thus proving the effectiveness of FSP on the microstructural modification and properties improvement for the CSed metal-metal composite coatings.