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Experimental Investigation and Optimization of Process Parameters of As-Sprayed Aerogel-Soda Lime Glass/NiCoCrAlYT_a Coating with Historical Data Design Response Surface Methodology (RSM)

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Abstract:

Atmospheric plasma spraying was employed to spray agglomerated aerogel-soda lime glass powders onto Inconel 625 substrate. This paper describes the development of statistical models to predict the optimum atmospheric plasma spray (APS) operating parameters such as current (200–800 A), powder feed rate (2.5 and 5 rpm), and spray distance (8, 10, 12, and 14 cm) on adhesion strength and thermal conductivity of as-sprayed Aerogel-soda lime glass/NiCoCrAlYT_a coating using historical data design of response surface methodology (RSM) from Design Expert 11. RSM is a well-organized statistical technique in forecasting variables in order to obtain the optimum operating conditions. The statistical approach used provides a high level of confidence and improves the processing. Significant effects of the process parameters on the microstructure were also observed. Optimum process conditions favourable for the formation of coating layers with the best coverage of agglomerated aerogel were statistically predicted at the current of 800 A, the powder feed rate of 5 rpm, and the spray distance of 13.54 cm with the maximum adhesion strength and minimum thermal conductivity predicted by RSM were 11.60 MPa and 10.30 W/mK respectively.