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Laser Post-Processing of Thermally Sprayed NiCrCoFeCBSi/WC Coatings

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Abstract

In order to improve the hardness and wear resistance of the thermally sprayed NiCrCoFeCBSi/40 wt.% WC coating, a transverse oscillating laser beam technique was applied for the post-remelting the coating. A single-module optical fiber laser was used for the experiments: power - 300 W, power density - $>9554 \text{ W/cm}^2$, laser speed - 250-1000 mm/min, transverse oscillation amplitude – 0 mm, 1 mm and 2 mm. The molten pool geometry and microstructure of the samples, hardness and tribology of the processed layers were investigated by applying scanning electron microscopy, energy dispersive spectroscopy, Vickers hardness measurements and “Ball-on-Disc” dry sliding tests. Oscillating laser treatment with 1 mm amplitude, 250–750 mm/min laser operating speed and preheated samples up to 400 °C gave a satisfactory result. Wide and shallow melt pools were obtained with a depth of about 200–350 μm , a hardness of about 1100–1200 HV0.2 and minimal cracks. Compared to the furnace remelted coatings, laser beam oscillation and preheating coatings increased hardness and wear resistance by ~2.8 times and ~2.9 times, respectively.

Keywords: laser remelting, preheating, oscillating, tribology, Vickers hardness