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Microstructure of NiCrBSiC coating hardfaced by plasma transfer arc welding process

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Colmonoy family alloys integrate the NiCrBSiC system and were developed to overcome problems associated with hardfaced iron and cobalt based alloys. They are acknowledged for their greater hardness and microhardness, in addition to their superior wear resistance, which they manage to maintain satisfactorily even when used at high temperatures for long periods. Their microstructure is generally made up of a matrix of nickel dendrites in addition to borides and carbides, which provide resistance to wear. In this work, we analyzed the addition metal chemical composition effect on the Vickers microhardness, hardness, microstructure and dilution of Colmonoy 5 coating deposited by plasma transfer arc welding process with powder addition. Alloy powders from different batches were used, and the confocal microscopy technique was applied in order to characterize, both qualitatively and quantitatively, their microstructure. Variation in dilution percentage was noted despite the same parameters were used for all deposition processes. It was found that the coating's microstructure consists of nickel-γ dendrites and an interdendritic region containing different constituents, in addition to borides and carbides. It was also observed that powders containing greater amounts of B, Cr and C result in the formation of coatings with a higher volumetric fraction of borides and carbides. Literature states that increases in the volumetric fraction of these second phase particles accentuate the hardening of these alloys; nevertheless, we found that the coating with lower volume fraction and boride size exhibited greater hardness. This finding makes the study of other microstructural and sub-structural characteristics necessary for identification and assessment of the hardening mechanisms acting on each coating.

Keywords: Colmonoy. Welding. Microstructural characterization.

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