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Weibull analysis of hardness distribution in detonation sprayed nano-structured WC-12Co coatings

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WC based cermet coatings were deposited by detonation spray coating (DSC) technique using nano WC-12Co feedstock at various oxygen to acetylene (oxy-fuel: OF) ratios on mild steel (MS) substrate. Microstructure and phase composition of feedstock and coatings were analyzed using scanning electron microscope (SEM) and x-ray diffraction (XRD) techniques. Microhardness of coatings was evaluated and analyzed statistically as a function of applied load (100 g and 300 g), while a total of 300 indentations performed at each load. Three body rubber wheel abrasive wear tests using SiC as an abrasive medium were carried out and the coating wear rates were calculated. The extent of decarburization in nano WC-12Co coatings increased with increase in OF ratio. The characteristic hardness (H_o) and Weibull modulus (m) were found to be influenced by the indentation load and coating microstructure. An increase in 'm' value and decrease in 'H_o' value were noticed with increasing indentation load. Coatings with similar characteristic hardness values have exhibited different Weibull modulus values. Based on the results obtained, the minimum number of indents required for arriving at the characteristic hardness value is calculated, the structure-property correlations were examined and the strategies based on Weibull parameters to achieve best possible properties and performance was proposed.

Keywords: Microhardness, nano WC-12Co, Weibull Modulus, Thermal spray, Detonation spray

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