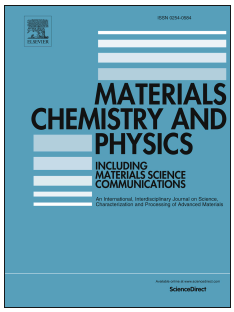

Investigation of WC decarburization effect on the microstructure and wear behavior of WC-Ni hardfacing under dry and alkaline wet conditions

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Investigation of WC decarburization effect on the microstructure and wear behavior of WC-Ni hardfacing under dry and alkaline wet conditions

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Abstract:

The performance of drilling tools hardfacing in different conditions is strongly related to microstructural aspect of the coating and to the adhesion with the substrate. In the present investigation, the manual oxy-acetylene brazing process was employed for AISI 1020 steel hardfacing using WC-Ni. The substrate/hard facing interface was particularly studied which was a Ni-Cr-Al-Mo interlayer prepared by flame thermal spray method. The microstructural results exhibit a good embedding of WC particles into the Ni matrix, where the inter-diffusion of Ni, Cr, and Fe elements at the interface is enhanced using the interlayer. The dissolution and decarburization phenomena of WC particles with the formation of W_2C eutectic phase and their effect on the decohesion and pull out of the particles during the wear test were studied. The hardness (H_{IT}) and Young's modulus (E_{IT}) of different parts of the hardfacing were investigated by instrumented nanoindentation. The wear resistance of the surface coatings under alkaline condition using sodium hydroxide (NaOH) basic solution of pH=12 is two times higher than under dry condition. Furthermore, the formation of SiO_2 third body stripes along the wear track promotes the decrease of the friction coefficient and the volume loss. On the other side, the wear mechanism is adhesive with severe plastic deformation of the Ni matrix in dry condition and oxidative/abrasive wear in alkaline wet condition.

Keywords: Interface, WC dissolution, Hardfacing. Inter-diffusion. Decarburization.