High efficiency chemical assisted nanofinishing of HVOF sprayed WC-Co coating

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Abstract: Thermally sprayed coatings are widely used to improve surface hardness and wear resistance of components. However, surface roughness of the as-sprayed coatings is higher than the acceptable limit for many applications in aerospace, automobile and printing industries. In the present study, a multi-step finishing strategy is adopted to improve the surface finish of high velocity oxy-fuel spraying (HVOF) sprayed WC-Co coating. Shape adaptive grinding (SAG) is performed using a zirconia-alumina abrasive polishing pad which resulted in differential finishing of WC and Co binder due to their significant hardness difference. To overcome this situation, chemical assisted SAG is performed using Murakami's reagent. A thin passivation layer is formed on the top of coating due to chemical interaction which has hardness many times lesser than the bare coating and facilitates high and uniform material removal rate. X-ray photoelectron spectroscopy measurements confirm the presence of WO_3 in the passivation layer. No fracture or WC fragmentation is observed on the surface processed using chemical assisted SAG. Areal surface roughness (Sa) is reduced from 5.04 μm to 53 nm using the above strategy.

Keywords— HVOF, WC-Co coating, Nanofinishing, Surface roughness, Murakami's reagent, Nanohardness.