The sintered nanostructured WC-Co materials have received increasing attentions as wear resistant components in a variety of industrial applications such as cutting and drilling tools and extrusion dies, due to their superior combination of hardness and fracture toughness. Despite the sintered materials, the nanostructured WC-Co coatings, mostly deposited by high velocity oxygen fuel (HVOF) thermal spray method, reveal an inferior wear resistance in comparison to their conventional microstructured counterparts. This arises from the high surface-to-volume ratio of nano-sized WC particles which accelerates their decomposition and decarburization during HVOF spraying leading to the formation of undesirable and brittle non-WC phases like $W_{٢}C$, Co_xW_yC and amorphous / nanostructured Co-W-C phases in the nanostructured coating structure. Therefore, this study is motivated by improving the thermal stability and tribological properties of nanostructured WC-Co coating deposited by HVOF spraying.

Firstly, electroless copper and nickel plating processes were distinctly applied on commercial microstructured WC-١٢Co (ms-WC١٢) particles to produce copper-coated (Cu/ms-WC) and nickel-coated (Ni/ns-WC) feedstock powders. These powders were then deposited onto the ST٣٧ steel substrates by HVOF spraying to form ms-WC١٢, Cu/ms-WC and Ni/ms-WC coatings. The carbon content analysis of each powder and resultant coating showed the decarburization levels of ١٦،٣, ٢١،٢ and ٢،٦٪, respectively for ms-WC١٢, Cu/ms-WC and Ni/ms-WC, representing extremely low WC decarburization for Ni/ms-WC.

Secondly, considering the protection role of electroless nickel layer against WC decarburization, the nanostructured WC-١٢Co (ns-WC) powder particles was produced by mechanical milling and subjected to electroless nickel plating to prepare nickel-coated nanostructured WC-Co (Ni/ns-WC) feedstock powder. Comparing the carbon content of ns-WC and Ni/ns-WC powders and coatings revealed decarburization levels of ٣٦،٨ and ٥،٤٪, respectively, indicating significant improvement in thermal stability of nano-sized WC during HVOF by using the nickel-coated feedstock powder.

In the third place, characteristics of ms-WC١٢, Cu/ms-WC, Ni/ms-WC, ns-WC and Ni/ns-WC coatings were investigated in terms of microstructural, mechanical and tribological properties as well as high temperature oxidation behavior, and the structure-properties-relationship for the coatings have been discussed in detail.

Keywords: WC-Co coating; HVOF; Microstructure; Mechanical properties; Tribological properties; Oxidation resistance.