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Tribological properties of high velocity suspension flame sprayed (HVSFS) ceramic coatings

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Abstract

Ceramic coatings were manufactured by high-velocity suspension flame spraying (HVSFS). Finely dispersed isopropanol-based suspensions with submicron- and nanoscaled Al_2O_3, 3-YSZ and TiO_2 powders were used as feedstock material. Microhardness, surface, microstructure, and phase composition of the final coating were characterized. The tribological properties were investigated via ball-on-disc test in NaCl solution and compared to those of high velocity oxy liquid fuel (HVOLF) sprayed WC/Co coatings. The ceramic coatings exhibited material specific hardness. The high surface roughness of Al_2O_3, mainly composed of γ-phase, and TiO_2, composed of anatase and rutile, could be explained by process inhomogeneities. While WC/Co was subjected to continuous wear due to abrasive processes and surface disruption, ceramic surfaces underwent a layer build-up, causing separation of the interacting surfaces and thus protection from increased wear. Considering tribochemical interactions between contacting materials and liquid medium, high chemical reactivity leads to high wear rates but moderate friction, whereas low reactivity results in low wear but high friction. Regarding potential application in pumps with SiC as standard material for sliding parts, 3-YSZ might be the most promising coating candidate due to moderate