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THE ROLE OF TiC RENFORCEMENT ON THE FRICTION AND WEAR OF COLD SPRAYED Ti6Al4V COATINGS

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ABSTRACT

Due to their high specific strength and excellent corrosion resistance, Ti alloys are useful materials in aerospace, automobile and marine applications [1]. However, their low resistance to plastic shearing and their non-protective tribo-oxides can result in high wear rates [2]. To improve the tribological properties of Ti alloys, reinforcing ceramic phases can be added to create a metal-matrix composite (MMC) [3,4]. In this study, Ti6Al4V-TiC MMCs were deposited as coatings using cold spray process. Composite coatings with two different TiC compositions 16 vol.% and 23 vol.% were deposited and their tribological properties were compared to Ti6Al4V coatings. Dry sliding wear tests were performed on the coatings at normal loads 0.5 N and 2.5 N using a WC-Co countersphere. Abrasive ploughing by the wear debris resulted in high wear of Ti6Al4V, whereas formation of protective tribolayers comprised of TiO_2 and fragmented TiC particles led to lower wear of composite coatings. Increased coverage and more rapid formation of the tribolayers was found to be tied to two factors: increased TiC in the initial coating and higher normal load for testing. Electron channel contrast imaging of the wear track cross-sections showed the formation of ultrafine grains and debonding of splats underneath the wear track in Ti6Al4V. For cross-sections of composite coatings, no splat debonding was observed and instead a coarse grain microstructure was found. The relationship between the coverage and mechanical properties of the tribolayers and the wear rate and subsurface microstructures will be discussed.

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