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Friction and Abrasive Wear Behaviour of Al_2O_3-13TiO_2 and Al_2O_3-13TiO_2+Ni Graphite coatings

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Abstract

The friction and abrasive wear of plasma sprayed Al_2O_3-13TiO_2 coating, with and without the addition of graphite was investigated. XPS analysis was used to determine the extent of γ-α Al_2O_3 phase transformation after wear. γ-α Al_2O_3 phase transformation had different influence on friction and wear of coatings. Al_2O_3-13TiO_2+15% Ni Graphite coating exhibited lower coefficient of friction and lower abrasive wear rates than Al_2O_3-13TiO_2 coating; the magnitude of decrease was dependent on load. The better abrasive wear resistance and lower coefficient of friction of Al_2O_3-13TiO_2+15% Ni Graphite coating was due to the synergistic effect of self-lubricating film of graphite and tribochemical reactions. The severity of contact could identify transitions in abrasive wear rates, operating wear mechanisms and associated failure modes.

Keywords: Al_2O_3 coating, Friction, Wear resistance, Fracture.

1. Introduction

Plasma sprayed Al_2O_3-TiO_2 coatings are widely used to improve wear, corrosion and high temperature properties of industrial components such as valves, pump shafts, rocket nozzles and bearings. The other application includes hydraulic components (pump, impellers, propellers and blowers) which are subjected to surface damage by solid particles, textile industry tools (thread guiding, ridge thread brakes), Ceramic membranes, Ozonizer tubes, Sink rolls, Corona rolls in printing and packaging industry, liner and ring in adiabatic engine, shipboard and submarine applications [1-6]. The wear performance of Al_2O_3-TiO_2 coatings is influenced by powder manufacturing technique [7], deposition technique [4], process parameters [8,9], microstructure [10,11] and resulting mechanical properties of coatings.

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