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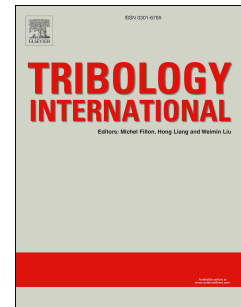
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Sliding wear behavior of air plasma sprayed Al_2O_3 coatings sealed with aluminum phosphate**Qun Wang^{a,b}, Chidambaram Seshadri Ramachandran^b, Gregory M. Smith^b, Sanjay Sampath^{*b}**^a College of Materials Science and Engineering, Hunan University, Changsha, Hunan 410082, PR China^b Center for Thermal Spray Research, Department of Materials Science and Engineering, Stony Brook University, Stony Brook, NY 11790, USA

Abstract In this investigation, aluminum phosphate was used to seal an air plasma sprayed alumina coating, the hardness, porosity, phase composition, microstructure, and the sliding wear performance of alumina coatings before and after sealing treatment were examined. The results showed that the aluminum phosphate can penetrate the interface between the alumina coating and the substrate. The microstructural features of the coatings such as pores, cracks, and gaps between splats were found to be filled with the sealant and the cross-sectional hardness of the sealed coating was increased from $962.7 \pm 77.2 \text{HV}_{0.3}$ to $1299.3 \pm 70.2 \text{HV}_{0.3}$. The critical load and sliding wear resistance of alumina coating can be greatly increased by aluminum phosphate sealing treatment.

Key words: Alumina coating, Aluminum phosphate, Sealing treatment, Sliding wear

1. Introduction

Air plasma sprayed alumina coatings are widely used to protect the parts which are subjected to wear and corrosion because to their high hardness and chemical stability [1-6]. They can also be deposited on the insulated metal substrates in automotive application for aluminum heat-sinks and the front plate inside the hard disk-drive of the computer to offer both electric insulation and a wear-resistant surface owing to their high hardness and good electrical insulation [7]. Due to the particle based assemblage and rapid quenching of the molten droplets, the deposits comprise numerous morphological defects including porosity associated with incomplete filling, interlamellar separations due to poor contact during successive impact, and micro and macro cracks associated with constrained contraction. The assortment of these defects leads in most situations to a permeable coating, which when used in harsh environmental situations such as aqueous corrosion, does not offer effective surface protection [2, 8, 9]. Chemical sealing treatment is one of the most commonly used methods to prevent migration of corrodents through the connected porosity of thermal sprayed ceramic and metallic coatings. Beyond the suppression of environmental permeation through the

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