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Axial suspension plasma spraying of Al_2O_3 coatings for superior tribological properties

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Abstract

Suspension plasma spray is a relatively new thermal spray technique which enables feeding of fine powder to produce advanced coatings for varied applications. This work investigates the difference in structure and performance of Al_2O_3 coatings manufactured using conventional micron-sized powder feedstock and a suspension of sub-micron to few micron sized powder. Axial injection was implemented for deposition in both cases. The effect of feedstock size and processing on the tribological performance of the two coatings was of specific interest. The coatings were characterized by Optical and Scanning Electron Microscopy, micro-hardness and scratch resistance testing, and their dry sliding wear performance evaluated. The suspension sprayed coatings yielded significantly higher scratch resistance, lower friction coefficient and reduced wear rate compared to conventional coatings. The improved tribological behaviour of the former is attributable to finer porosity, smaller splat sizes, and improved interlamellar bonding.

Keywords

Atmospheric plasma spray, Suspension plasma spray, Axial injection, Alumina, Coating, Microstructure, Micro-hardness, Scratch, Wear

1. Introduction

Atmospheric plasma spray (APS) is an industrially well-accepted and versatile thermal spray technique which enables deposition of variety of materials such as metals, intermetallics,