

Contribution ID: 474

Type: Oral Presentation

Enhancing 100Cr6 Steel Surface Performance with Thermally Sprayed Alumina: Mechanical, Electrical, and Tribological Evaluation

Tuesday 7 October 2025 14:50 (20 minutes)

This research investigates the enhancement of surface performance in 100Cr6-bearing steel through the application of alumina (Al_2O_3) ceramic coatings via thermal spraying, focusing on mechanical, tribological, and electrical characteristics. Coatings were applied using Atmospheric Plasma Spraying (APS) with varying thicknesses and assessed with or without a metallic interlayer and post-deposition sealant. The metallic interlayer was designed to improve adhesion and reduce thermal mismatch stresses, while the sealants were used to minimize surface porosity and enhance dielectric properties.

The influence of coating properties and integrity was assessed through comprehensive experimental analysis. Mechanical characterization included microhardness testing and three-point bending tests to evaluate coating integrity and identify crack formation and failure modes under stress. Profilometry and scanning electron microscopy (SEM) were employed to analyze surface roughness and coating morphology, establishing a link between surface features and functional performance. SEM also examined the top surface and cross-sections of coatings post-bending to explore failure mechanisms and ceramic-substrate integrity. Energy Dispersive X-ray (EDX) mapping was used to assess material composition and interfacial bonding.

Tribological behavior was evaluated through dry sliding ball-on-disk tests, while electrical resistivity measurements were conducted to determine the insulating properties of the coatings. Additional mechanical tests were also performed to evaluate various coating performances.

This research aims to optimize the design of thermally sprayed alumina coatings by examining how coating thickness, interlayers, and sealant applications affect surface performance, adhesion, and Failure behaviour. The findings provide crucial insights for developing multifunctional ceramic coatings for steel components in demanding applications, such as hybrid bearings and electrically isolated systems.

Keywords: 100Cr6 Steel, Alumina Ceramic Coating, Atmospheric Plasma Spraying (APS), Electrical Insulation, Mechanical characterization, Thermal Spray Coatings, Tribology.

Primary author: Mrs SHEIBANIAN, NAZANIN (1. DIMEAS, Department of Mechanical and Aerospace Engineering, Polytechnic University of Turin / 2.TN ITALY, Central Laboratory, Corso Torino 378, 10064 Pinerolo, Italy)

Co-authors: Mr UVA, Andrea (TN ITALY, Central Laboratory); Prof. SESANA, Raffaella (DIMEAS, Department of Mechanical and Aerospace Engineering, Polytechnic University of Turin); Mr RIZZO, Sebastiano (TN ITALY, Central Laboratory)

Presenter: Mrs SHEIBANIAN, NAZANIN (1. DIMEAS, Department of Mechanical and Aerospace Engineering, Polytechnic University of Turin / 2.TN ITALY, Central Laboratory, Corso Torino 378, 10064 Pinerolo, Italy)

Session Classification: Surface Technologies

Track Classification: Surface technologies