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Structure and electrical insulation characteristics of plasma-sprayed alumina coatings under pressure

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Abstract

In this work, alumina coatings were fabricated on 316LN austenitic stainless steel by a plasma spray technique. The pressure dependence of the surface electrical resistivity of alumina coatings was investigated in detail. A combination of scanning electron microscopy and X-ray diffraction was employed to understand the microstructure and properties of the as-sprayed alumina coatings. The coatings can endure high pressures under a practical working environment. The surface electrical resistivity of the alumina coatings decreases continuously with an increase in pressure to 250 MPa. Interestingly, the surface resistivity is still greater than $10^7 \Omega \cdot \text{mm}$ for 250 MPa, demonstrating that the coatings have good electrical insulation properties and can be fully utilized in the magnet support of ITER.

Keywords: Alumina coatings; Surface resistivity; Crystal structure; X-ray techniques

1 Introduction

Conductors can give rise to a large eddy current in International Thermonuclear Experimental Reactor (ITER) magnet supports due to the presence of self-resistance. The insulation coatings can withstand the high force, strong magnetic field and cryogenic temperature that occur during operation, so outstanding electrical insulation

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