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## Nanolayered multilayer Ti/TiN coatings: Role of bi-layer thickness and annealing on solid particle erosion behaviour at elevated temperature

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### Abstract

Solid particle erosion is a very serious and inevitable issue faced by key components of modern machinery in various applications such as compressor blades and vanes of turbine engines, and turbine blades of advanced aircraft engines. In this direction third generation Ti/TiN nanolayered multilayered erosion resistant coatings were developed using sputtering technique. Films of around 7-10  $\mu\text{m}$  total thickness with bi-layer thicknesses from 7.5-115 nm were deposited. Structural and mechanical properties such as hardness, toughness and stress of the films were studied, and correlated with the bi-layer thickness and deposition conditions. Erosion test was carried out according to ASTM G76-13 standard parameters at 30, 45, 60, and 90° impinging angles. Since the compressor blades of the gas turbine engines usually operate at 100 to 550°C, the erosion tests were conducted at 400°C. Films with lower bi-layer thickness showed better erosion resistance in comparison with higher bi-layer thickness films. Further, effect of bi-layer thickness, annealing and internal stress of the films on erosion resistance performance is studied. Detailed studies revealed that the optimized coating exhibited an improvement in the erosion performance by a factor of 15.

**Keywords:** Ti/TiN multilayers, Erosion resistance, Nanolayered multilayered coating, Effect of bilayer thickness

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