



Scratch adhesion and wear failure characteristics of PVD multilayer CrTi/CrTiN thin film ceramic coating deposited on AA7075-T6 aerospace alloy

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ABSTRACT

This study highlights the scratch adhesion failure characterization and tribo-mechanical properties of physical vapor deposited (Cr, Ti) N coating on AA7075-T6 by using magnetron-sputtering technique. The surface morphology, microstructure and chemical composition of CrTi/CrTiN film were inspected by an optical microscope, scanning electron microscope (SEM) incorporated with energy dispersive X-ray spectroscopy (EDX) in addition to focused ion beam milling. The coating to substrate critical load of about 1261 mN was obtained, by employing coating deposition parameters of; DC power (300 W, RF power (200 W)), temperature (300 °C) and nitrogen flow rate (6%). Failure adhesion characteristics exhibited initial arc-tensile cracking followed by chipping and spallation that led to complete coating failure at L_{c3} . The tribo-mechanical aspects were evaluated by a pin-on-plate reciprocating testing unit, which showed a lower friction coefficient of 0.36 for CrTiN as compared with 0.43 for AA7075-T6. Subsequently, the wear depth was also reduced from 9.5 to 5.9 μm . It was revealed that the wear mechanism for AA7075-T6 was extensive deformation, abrasion and delamination, while the CrTiN exhibited slightly oxidative abrasive wear mode.

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