Investigating the fretting fatigue life of thin film titanium nitride coated aerospace Al7075-T6 alloy

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Abstract:

Application of surface modification methods is expected to be a supreme solution to diminishing fretting damage. In this study, our aim was to improve the fretting fatigue life of Al7075-T6 alloy by covering it with a TiN thin film hard coating using the magnetron sputtering technique. Coated specimens with the best surface hardness, adhesion strength and roughness were tested with a rotating bending fatigue test machine. The fatigue results indicate that fretting was significantly detrimental and reduced the fatigue life of uncoated specimens, while a slighter decrease was observed for coated samples with high surface hardness and adhesion. The fretting fatigue lives of coated specimens with high surface hardness and adhesion strength improved 61% and 16% at high bending stress and 39% and 77% at low bending stress, respectively, in comparison to the uncoated specimens. In addition, the lowest surface roughness resulting from thin film TiN coating improved the fretting fatigue life of specimens by 18% at low cyclic fatigue, while at high cyclic fatigue the result was reversed.

Keywords:

Fretting fatigue; Aluminium7075-T6 alloy; Magnetron sputtering; Titanium nitride coating

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