Effect of Pre-Corrosion and Shot peening on the Fretting Fatigue Properties of Ti6Al4V Titanium Alloy

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Abstract The dovetail assembly of titanium alloy compressor blades for aircraft engines serving in marine environments will experience corrosion and coupled fretting fatigue damage. Therefore, this article explores the effects of salt spray pre corrosion and shot peening on the fretting fatigue performance of Ti6Al4V titanium alloy. Research has shown that shot peening can significantly improve the fretting fatigue resistance of Ti6Al4V titanium alloy; The one month salt spray pre corrosion has no significant effect on the fretting fatigue performance of Ti6Al4V titanium alloy substrate; However, within the test stress range of 250MPa - 650MPa, salt spray pre corrosion actually improved the fretting motion fatigue life of Ti6Al4V titanium alloy subjected to shot peening treatment. Among them, the fretting motion fatigue life increased the most under the test condition of 450MPa stress, with an increase of 44.4%. This is due to the solid lubrication effect of the corrosion products on the surface of the shot peened titanium alloy sample and the NaCl solid particles accumulated in the shot pits, which reduced the fretting motion damage on the surface of the titanium alloy and thus improved its fretting motion fatigue life.

Keywords Salt spray pre-corrosion, Fretting fatigue, Shot peening strengthening, Ti6Al4V titanium alloy

Reference

[1] K. Fan, D. Liu, X. Zhang, D. Liu, W. Zhao, J. Yang, A. Ma, M. Li, Y. Qi, J. Xiang, M. Abdel Wahab, Effect of residual stress induced by ultrasonic surface rolling on fretting fatigue behaviors of Ti-6Al-4V alloy, Engineering Fracture Mechanics 259 (2022) 108150.

[2] C. Wang, K. Fan, C. Li, M. Abdel Wahab, Prediction of the effect of shot peening residual stress on fretting fatigue behaviour, International Journal of Fatigue 176 (2023) 107909.

[3] K. Fan, D. Liu, C. Wang, J. Yang, Y. Liu, X. Zhang, J. Xiang, M. Abdel Wahab, Effect of contact stress and slip amplitude on fretting fatigue behaviour of ultrasonic

surface nanocrystallized TC11 titanium alloy, Journal of Materials Research and Technology 28 (2024) 4052–4064.

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