

Influence of Subjection to SBF on Ultra-high Cycle Fatigue Behaviors of Ti-6Al-4V

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Summary

Ti-6Al-4V is widely used in biology engineering as well medical implant. Clinical investigations show that TC4 implant could have rupture of passivation film and visible corrosion. To predict service life of the Ti-6Al-4V implant, it is necessary to study its ultra-high cycle fatigue behaviors in physiological environment exceeding 10^7 cycles. In this paper, using the ultrasonic fatigue testing technique, the high cycle and ultra-high cycle fatigue properties of Ti-6Al-4V subjection to simulated body fluid (SBF) in body temperature were studied and compared with that of normal Ti-6Al-4V. The experimental results show that SBF subjection has slight influence on the ultra-high cycle fatigue life of such material; the S-N curves descend continuously during 10^4 and 10^9 cycles and the descending tendency is lower in the region of 10^7 - 10^8 cycles; fracture can still occur beyond 10^7 cycles showing there is no fatigue limit as the traditional fatigue conception describes. The observation of fracture surface investigated by scanning electron microscopy (SEM) and energy dispersive atomic X-ray (EDA X-ray) shows cracks mainly initiate from surface of specimen before the fatigue life of 10^7 cycles and some specimens have multiple crack initiation sites; fatigue failure initiates from internal inclusion where mostly the element Al aggregates after the fatigue life of 10^8 cycles.

