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Effect of grain size on dwell fatigue behaviour of Ti-5Al-2.5Sn alloy

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It is a well known and important problem in the industry that some alloys, especially titanium ones shows a significant reduction in fatigue life, termed dwell debit, if a stress dwell is included in the fatigue cycle. Many earlier studies has shown its strong dependence on grain size and micro-texture of material. In order to understand the effect of grain size, normal fatigue and dwell fatigue were carried out on Ti-5Al-2.5Sn ELI alloys with three distinct grain sizes. Lowest grain size (≈ 9 μm) material has shown the largest lifetime and lowest dwell debit. However, the material with ≈ 35 μm grain size showed the lowest lifetime and highest dwell debit. An increase of grain size further to ≈ 100 μm again increased lifetime and lowering of dwell debit. EBSD micrographs of tested samples were obtained using a scanning electron microscope to study microstructure and micro-texture in detail. The bulk texture was also calculated using X-ray diffraction. Fractography on failed samples was done to determine the cause of failure and path of crack propagation. Facet separation and propagation mechanism was obsereved along with exhaustion failure. Different degrees of the two mechanisms were observed in different grain size samples.

Keywords: *Ti-5Al-2.5Sn; Dwell fatigue; EBSD.*

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