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Characteristics of Very-High-Cycle Fatigue for a High Carbon Low Alloy Steel

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This paper described an experimental investigation on the behavior of very- high-cycle fatigue (VHCF) for a high carbon low alloy steel (main composition: C 1% and Cr 1.5%). Fatigue testing was carried out in a rotating loading machine with a cyclic frequency of 52.5 Hz. The specimen is of hour-glass cylindrical type with the minimum section diameter of 3 mm. The results showed that, for the number of cycles to failure between 10^6 and $4 \cdot 10^8$ cycles, fatigue cracks almost initiated in the interior region of specimen and originated at non-metallic inclusions. The fatigue life of specimens with crack origin at the interior of specimen is longer than that with crack origin at specimen surface. Fractography observations of scanning electron microscopy indicated that fish-eye patterns were the main characteristics of VHCF, which was responsible for the predominant part of fatigue life. The mechanism of VHCF was discussed in terms of fracture mechanics.

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