

PROCEEDINGS

Thermodynamic Investigation with Synergetic Method on Inner Crack Growth Behavior at very High Cycle Fatigue Regime

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ABSTRACT

This paper presents a thermodynamic characterization method for estimating the internal crack growth rate, which has been a puzzle in very high cycle fatigue research. A theoretical approach of surface temperature is established with crack size, initiation site, and time for thin sheet material. Infrared thermography is used to study the inner crack behavior and the heat dissipation phenomenon under 20 kHz vibration loading on high-strength stainless steel. A numerical simulation reveals the consequent temperature elevation on the surfaces by the heat generation at the crack tip and the heat conduction. Ultimately, the internal crack growth rate and final fatigue failure prediction are obtained by combining the calculation of heat dissipation and the observed evolution of the surface temperature field.

KEYWORDS

Very high cycle fatigue; internal crack; fatigue crack propagation; infrared thermography; thermal dissipation

Funding Statement: The author(s) received no specific funding for this study.

Conflicts of Interest: The authors declare that they have no conflicts of interest to report regarding the present study.



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