Evaluation of Multiaxial Fatigue Models for Ti-6Al-4V

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Background

Ti-6Al-4V is commonly used in turbine engines.

Multiaxial fatigue is a design consideration for turbine engines.

AFRL recently purchased the MTS 809 Axial-Torsional Test System.

Testing

Axial fatigue tests were completed in a previous project.

Torsional fatigue tests used polished torsional fatigue specimens.

Torsional fatigue specimens were subjected to cyclic shear stress in MTS 809 until they fractured.

Modeling

Findley Model

Findley Parameter $= \frac{\Delta \tau}{2} + k\sigma_{\text{max}}$

Goodman Model

Goodman Parameter $= \sigma_a \left( \frac{S_y}{S_u - \sigma_m} \right)$

SWT Model

SWT Parameter $= \sqrt{\sigma_a (\sigma_a + \sigma_m)}$

Evaluation of Models

Fractography

SEM images of the fracture surface confirm that fracture did not occur due to a stress concentration or surface defect.