Combined tension and bending fatigue life assessment method of blade-like specimen considering the effect of non-uniform tension-bending stress distribution and multi-damages

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Abstract

This paper proposes a novel combined cycle fatigue life prediction method of a blade-like specimen considering the effect of multiple damage modes and complex stress state. Combined tensile and bending fatigue (CTBF) experiments were performed on a blade-like specimen at 850°C, using a novel biaxial tension-vibration test system. To account for the effect of high stress ratio related creep on bending fatigue damage, a creep damage factor was proposed and explicitly introduced into Lemaitre-Chaboche model. In the framework of continuum damage mechanics (CDM), the CTBF life was assessed considering the geometry-stress gradient feature factor and multiple damage modes, including the damage of LCF, high stress ratio bending fatigue and oxidation. Finally, a novel CTBF life prediction model was proposed, agreeing well with the experimental results. Compared with the existing classical models, the proposed model provides the significantly higher prediction accuracy.

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