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Tension and compression dwell fatigue behaviour of austenitic cast iron D5S: A crystal plasticity study

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To investigate the influence of dwell time on the fatigue life and the corresponding failure mechanisms of austenitic cast iron D5S, creep fatigue tests are conducted at 800 °C under both tension and compression dwell [1,2,3]. In addition, the results of low-cycle fatigue tests without dwell are used as a reference. The experimental investigations are accompanied by crystal plasticity simulations based on full-field micromechanical modelling of the tested specimens. In the present work, the predicted dwell fatigue behaviour and the experimental results show good agreement. It is also found that the addition of both tension and compression dwell significantly reduces the fatigue life compared to the reference test. Compression dwell is more detrimental and leads to the formation of large cavities at the graphite-matrix interface. Tension dwell, on the other hand, leads to the formation of creep pinholes at the graphite-matrix interface resulting in microcrack initiation.

Keywords: Creep fatigue, Low-cycle fatigue, Crystal plasticity, Ductile cast iron

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