Fatigue crack growth behaviour of an alternative single crystal nickel base superalloy

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Abstract

The fatigue crack growth behaviour of a single crystal nickel base superalloy was studied at three different temperatures (20°C, 500°C and 750°C) and three different crystallographic orientations. At the highest testing temperature, the influence of hold time at maximum load was also evaluated. Under some of the testing conditions, crystallographic crack growth occurred along {111} planes, which were non-perpendicular to the loading direction. The propensity for crystallographic cracking was observed to be strongly temperature dependent with a maximum occurring at the intermediate testing temperature of 500°C. During non-crystallographic, Mode I crack growth the crack tended to avoid the γ′ particles and propagated preferentially through the γ matrix.

Keywords: single crystal superalloy, fatigue, crack growth, crystallographic crack growth, temperature dependence, orientation dependence, hold time influence