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The effect of the beta phase on the micromechanical response of dual-phase titanium alloys

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Abstract

This paper investigates the role of beta phase on the micro-mechanical behaviour of dual-phase titanium alloys, with particular emphasis on the phenomenon of cold dwell fatigue, which occurs in such alloys under room temperature conditions. A strain gradient crystal plasticity model is developed and calibrated against micro-pillar compression test data for a dual-phase alpha-beta specimen. The effects of key microstructural variables, such as relative beta lath orientation, on the micromechanical response of idealised alpha-beta colony microstructures are shown to be consistent with previously-published test data. A polycrystal study on the effects of the calibrated alpha-beta crystal plasticity model on the local micromechanical variables controlling cold dwell fatigue is presented. The presence of the alpha-beta phase is predicted to increase dwell fatigue resistance compared to a pure alpha-phase microstructure.

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