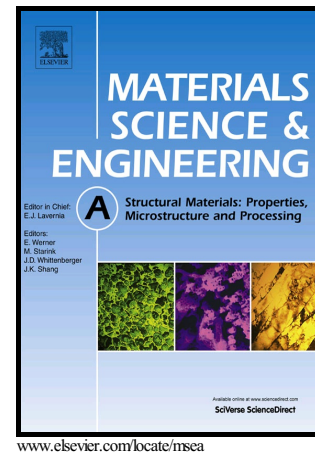


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Influence of Laves phase on creep strength of modified 9Cr-1Mo steel

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Abstract

The influence of Laves phase in the microstructure on the creep strength of a modified 9Cr-1Mo tempered ferritic steel, F91, is investigated in this research. Through additional aging heat treatment up to 5,000 hours, a pronounced increase of Mo-rich Laves phase is found around Cr-rich carbide $M_{23}C_6$, which is pinned on the prior-austenite grain boundaries and martensitic lath boundaries. This secondary precipitation hardening provided by the Laves phase is rapidly offset by its coarsening into large clusters during long-term thermal exposure and under creep conditions, leading to earlier creep rupture than the pristine material. Uniaxial constant-load creep tests are conducted on both aged and non-aged coupons under the same creep conditions. The creep rupture behaviour of both materials is rationalized with the assistance of a deformation-mechanism-based true-stress creep model that was developed in the previous work. The effects of Laves phase on the creep strength of F91 are related to its influence on the well-recognized existing deformation mechanisms: dislocation glide, dislocation climb, and grain boundary sliding.

Keywords: Laves phase, Modified 9Cr-1Mo steel, Creep, Deformation-mechanism-based model,

Heat treatment

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