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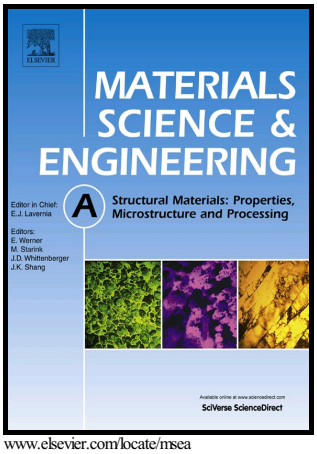

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A physically-based creep damage model for effects of different precipitate types

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Abstract

The development of a new precipitate coarsening continuum damage mechanics (CDM) model to simulate the multi-precipitate strengthening mechanisms present in 9Cr steels under high temperature creep deformation is presented here. The key strengthening and degradation associated with the different coarsening kinematics and volume fractions associated with $M_{23}C_6$ and MX precipitates in 9Cr steels are simulated within a CDM framework for the first time. The new CDM creep model is implemented in a uniaxial code and successfully applied to 9Cr steels across a range of temperatures via physically-based steady-state creep constants. The role of increasing Al content on the high temperature creep behaviour of 9Cr steels is simulated via varying the volume fraction of MX carbonitrides. The results highlight (i) the important role of MX carbonitrides on creep strength of 9Cr steels and (ii) the requirement to simulate steady-state creep behaviour in 9Cr steels from a physical basis**.**

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