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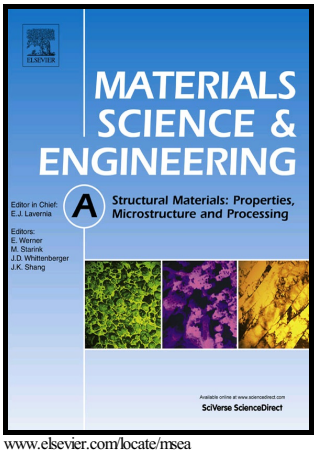

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Deformation-mechanism-based modeling of creep behavior of modified 9Cr-1Mo steel

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ABSTRACT

A deformation-mechanism-based true-stress creep model is proposed for studying the creep behavior of modified 9Cr-1Mo steel in this research. Constant-load creep test is conducted on modified 9Cr-1Mo steel in forged form (F91). The creep data obtained in the present study and those reported from the National Institute for Materials Science (NIMS, Japan) on modified 9Cr-1Mo steels processed by different means are analyzed. It is revealed that the relationship of minimum creep rate versus applied engineering stress exhibits distinct power exponent n in three stress regions, which are associated with different deformation mechanisms. The proposed model considers three well recognized deformation mechanisms: dislocation glide, dislocation climb, and grain boundary sliding. The analyses of the experimental data show that this deformation-mechanism-based model can describe fairly well the entire creep deformation process consisting of primary, steady-state, and tertiary creep.

Keywords: Deformation-mechanism-based model, Modified 9Cr-1Mo steel, Creep, Heat treatment, Thermomechanical processing