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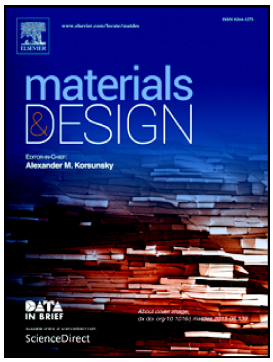

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The improvement on constitutive modeling of Nb-Ti micro alloyed steel by using intelligent algorithms

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Abstract: The deformation behavior of Nb-Ti micro alloyed steel was experimentally obtained in the deformation temperature range of 900-1050 ℃ and strain rate range of 0.1-10 s^{-1}. Base on the stress-strain curves, four constitutive models were established by using the modified forms of Arrhenius-type model considering compensation of strain or modified by intelligent algorithms such as artificial neural network and genetic algorithm. A comparative study has been made on the accuracy and effectiveness of the four models to predict the flow stress of Nb-Ti micro alloyed steels. The result shows that models modified by intelligent algorithms acquire higher accuracy than Arrhenius-type model considering compensation of strain. The model whose material parameters (α, n, Q and ln$A$) are modeled by artificial neural network performs better than the model whose material parameters (α, n, Q and ln$A$) are optimized by genetic algorithm. Among all the models, Arrhenius-type model considering compensation of strain with errors revised by artificial neural network obtains the highest accuracy.

Keywords: Nb-Ti micro alloyed steel, hot deformation behavior, flow stress, Arrhenius-type model, genetic algorithm, artificial neural network