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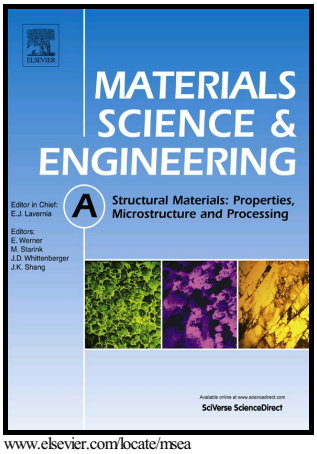

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Stability of retained austenite in martensitic high carbon steels. Part I: Thermal stability

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Abstract

Thermal stability of retained austenite in 1C-1.5Cr steels with two Si and Mn contents is studied. Time-resolved high resolution synchrotron X-ray radiation and dilatometry are employed. The threshold transformation temperatures, decomposition kinetics, associated transformation strain, as well as the influence of Si and Mn were investigated. The coefficients of linear thermal expansion for both the bulk materials and individual phases are also obtained. The results indicate that an increase in the Mn and Si contents show little influence on the onset of retained austenite decomposition, but result in more thermally stable austenite. The decomposition is accompanied by a simultaneous increase in ferrite content which causes an expansive strain in the order of 10^{-4}, and subsequent cementite development from 300–350 °C which causes a contraction that helps to neutralise the expansive strain. During decomposition, a continuous increase in the carbon content of austenite, and a reduction in that of the tempered-martensite/ferrite phase was observed. This process continued at elevated temperatures until full decomposition was reached, which could take less than an hour at a heating rate of 0.05 °C/s. Additionally, the observation of austenite peak splitting on samples with high Mn and Si contents suggests the existence of austenite of different stabilities in such matrix.

Keywords: Austenite, Phase stability, Synchrotron radiation, Dilatometry, Martensitic

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