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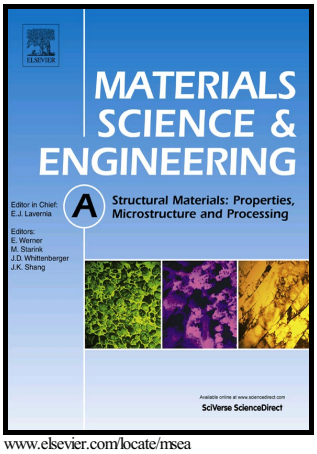

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PII: S0921-5093(18)30231-4
DOI: https://doi.org/10.1016/j.msea.2018.02.048
Reference: MSA36135

To appear in: *Materials Science & Engineering A*

Received date: 19 October 2017
Revised date: 6 February 2018
Accepted date: 11 February 2018

Cite this article as: Andreas Jilg and Thomas Seifert, Temperature dependent cyclic mechanical properties of a hot work steel after time and temperature dependent softening, *Materials Science & Engineering A,* https://doi.org/10.1016/j.msea.2018.02.048

Temperature dependent cyclic mechanical properties of a hot work steel after time and temperature dependent softening

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Abstract

In this paper, the temperature dependent cyclic mechanical properties of the martensitic hot work tool steel 1.2367 after tempering are investigated. To this end, hardness measurements as well as monotonic and cyclic tests at temperatures in the range from room temperature to 650 °C are performed on material tempered for different tempering times and temperatures. To describe the observed time and temperature dependent softening during tempering a kinetic model for the evolution of the mean size of secondary carbides based on Ostwald ripening is developed. Furthermore, mechanism-based as well as phenomenological relations for the cyclic mechanical properties of the Ramberg-Osgood model depending on carbide size and temperature are introduced. A good overall agreement of the measured and the calculated stress-strain hysteresis loops for different temperatures and heat treatments is obtained using the determined material properties of the kinetic and mechanical model.

Keywords: Thermal softening, Ostwald ripening, Hot work tool steel, Particle hardening, Ramberg-Osgood relationship

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