Microstructure and flow stress evolution during hot deformation of 304L austenitic stainless steel in variable thermomechanical conditions

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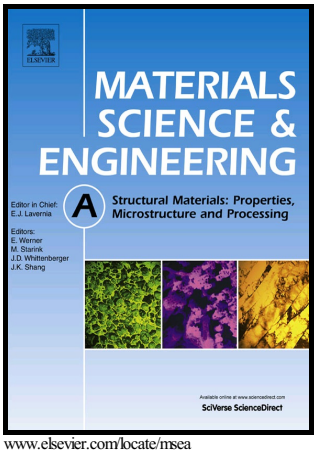

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PII: S0921-5093(17)31499-5
DOI: https://doi.org/10.1016/j.msea.2017.11.042
Reference: MSA35757

To appear in: *Materials Science & Engineering A*

Received date: 10 March 2017
Revised date: 13 October 2017
Accepted date: 11 November 2017

Cite this article as: K. Huang and R.E. Logé, Microstructure and flow stress evolution during hot deformation of 304L austenitic stainless steel in variable thermomechanical conditions, *Materials Science & Engineering A*, https://doi.org/10.1016/j.msea.2017.11.042

Microstructure and flow stress evolution during hot deformation of 304L austenitic stainless steel in variable thermomechanical conditions

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Abstract

Most of industrial hot deformation processes are performed in variable conditions where the strain rate and/or deformation temperature are not constant. In this work, hot compression tests in both constant and varying strain rate conditions were performed on 304L austenitic stainless steel using a Gleeble 3800 machine. The variations in microstructure and flow stress during and after the transient deformation stage are carefully analysed. It is clearly shown that, following the abrupt increase of strain rate, both the flow stress and substructural changes are subjected to a transient period over strains of ~0.2, before reaching states similar to those developed through constant strain rate conditions at the new strain rate. When the strain rate was rapidly decreased, the flow stress transient stage extended over a lower strain interval than the substructure transient period. It is shown that local misorientation distributions are good indicators of the deformation microstructure of low SFE materials as they capture small variations in deformation structures which cannot be analysed from stress-strain curves alone.

Keywords: Hot deformation; Transient deformation; Microstructure; Flow stress; Numerical model; Austenitic stainless steel.

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