Accepted Manuscript

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PII: S0925-8388(16)30138-4

DOI: 10.1016/j.jallcom.2016.01.137

Reference: JALCOM 36488

To appear in: *Journal of Alloys and Compounds*

Received Date: 9 November 2015

Revised Date: 10 January 2016

Accepted Date: 17 January 2016

Please cite this article as: G. Liu, J. Li, S. Zhang, J. Wang, Q. Meng, Dilatometric study on the recrystallization and austenization behavior of cold-rolled steel with different heating rates, *Journal of Alloys and Compounds* (2016), doi: 10.1016/j.jallcom.2016.01.137.

Dilatometric study on the recrystallization and austenization behavior of cold-rolled steel with different heating rates

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Abstract

Recrystallization and austenization behavior of cold-rolled 0.22C-1.3Mn-1.4Si steel in continuous heating with 0.5 °C/s, 5 °C/s, 50 °C/s, 300 °C/s had been studied using dilatometry and metallographic analysis. It is found that heating rate strongly influences the overlap extent of ferrite recrystallization and austenite formation process which reflect on both of the dilatometric curves and the evolution of microstructures. At heating rate of 0.5 °C/s, thermal expansion coefficient declines and regresses before Ac1 which corresponding to the recrystallization begins and finishes. At higher heating rate, austenization begins partially with the deformed structures and recrystallization is still ongoing along with the austenite formation. The overlaps are proved to introduce the bias and errors in describing the kinetics of austenite formation measured from dilatometric curves by lever rule. Decoupled dilatometric curves which striped the deviation caused by recrystallization are established. The austenite fraction volumes measured by the new curve agree well with the results measured by quantitative metallography.

Key words: Cold-rolled steel, Dilatometry, Recrystallization, Austenization, Decouple