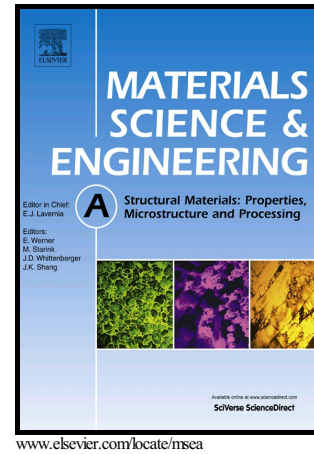


Author's Accepted Manuscript

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PII: S0921-5093(17)31011-0
DOI: <http://dx.doi.org/10.1016/j.msea.2017.08.006>
Reference: MSA35354

To appear in: *Materials Science & Engineering A*

Received date: 31 March 2017
Revised date: 4 July 2017
Accepted date: 2 August 2017

Cite this article as: Berkay Bayramin, Caner Şimşir and Mert Efe, Dynamic Strain Aging in DP Steels at Forming Relevant Strain Rates and Temperatures *Materials Science & Engineering A* <http://dx.doi.org/10.1016/j.msea.2017.08.006>

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Dynamic Strain Aging in DP Steels at Forming Relevant Strain Rates and Temperatures

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ABSTRACT

Mechanical testing of dual phase (DP) steels at low strain rates (10^{-3} s^{-1}) have shown that they are susceptible to dynamic strain aging (DSA) between 100°C - 400°C . During industrial forming processes at intermediate strain rates ($1 - 10^2 \text{ s}^{-1}$), the local temperatures may rise to the DSA range due to deformation heating which may disturb the exceptional formability of these steels. In this study, two grades of DP steel (DP590 and DP800) are tested at thermomechanical conditions relevant to forming and the effects of DSA on the formability are established. Test results show that the DSA controls the deformation between 200°C - 300°C through serrations in the stress-strain curves of both grades. With increasing strain rates (up to 1 s^{-1}) and temperatures, DSA intensifies and results in severe drops in uniform and total ductility with negative strain rate sensitivity, indicating poor formability at these conditions. A detailed analysis of the serrations coupled with dislocation density measurements by x-ray analysis suggests that the serrations can be linked to a periodic microstructural feature.

Keywords: Dual-Phase Steels, DSA, Formability, Warm Forming, Dislocation Cells

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