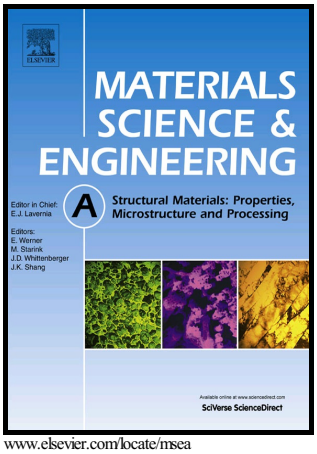
On the microstructure control of the bendability of advanced high strength steels

C. Suppan, T. Hebesberger, A. Pichler, J. Rehrl, O. Kolednik



www.elsevier.com/locate/msea

PII: S0921-5093(18)31014-1
DOI: https://doi.org/10.1016/j.msea.2018.07.080
Reference: MSA36744

To appear in: *Materials Science & Engineering A*

Received date: 27 February 2018
Revised date: 20 July 2018
Accepted date: 23 July 2018

Cite this article as: C. Suppan, T. Hebesberger, A. Pichler, J. Rehrl and O. Kolednik, On the microstructure control of the bendability of advanced high strength steels, *Materials Science & Engineering A*, https://doi.org/10.1016/j.msea.2018.07.080

On the microstructure control of the bendability of advanced high strength steels

C. Suppan[1,*], T. Hebesberger[1], A. Pichler[1], J. Rehrl[1], O. Kolednik[2]

[1]*voestalpine Stahl GmbH, voestalpine-Strasse 3, 4020 Linz, Austria*

[2]*Erich Schmid Institute of Materials Science, Austrian Academy of Sciences, Jahnstrasse 12, 8700 Leoben, Austria*

Abstract

The formability of newly developed steel grades is a key parameter for their successful implementation in the car body. In the present work, the influence of the microstructure on formability during air bending is studied. First- and third-generation advanced high strength steels with tensile strengths above 1000 MPa are investigated, which exhibit a broad range of microstructural constituents (ferritic bainite, bainite, martensite, and retained austenite). Interrupted bending experiments are performed on two grades of dual phase and complex phase steels, respectively, in order to reveal the microscopic deformation and failure processes. The formability in hole expansion tests is determined and used as a measure for the resistance of the materials against crack formation. The macroscopic deformation behavior of the materials is taken into account by measuring the differential strain hardening exponent and performing finite element simulations of the air bending process. Advantages and disadvantages of various microstructural features are worked out, and it is explained why the first-generation dual phase steel exhibits the lowest and the third-generation complex phase steel the best formability during air bending.

Keywords

Dual phase steel, complex phase steel, microstructure, bending, shear band formation, crack initiation

* Corresponding author.

E-mail address: clemens.suppan@voestalpine.com (C. Suppan)