

Influence of microstructural heterogeneities on capacity to absorb energy of dual-phase steels

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The effect of microstructural banding (or so called segregation bands) on energy absorption capacity of dual-phase steels (DP steels) was examined by product of tensile strength and uniform elongation (TS×UE), as well as by Charpy V-notch impact test. A series of DP steels with different volume fractions of martensite (VFM) was prepared by intercritical annealing at temperatures ranging 740 to 840 °C. It was found that increasing of VFM has an inverse effect on values TS×UE and notch toughness. The results on samples with a notch and pre-cycled crack showed that presence of segregation bands influences capacity of steels to absorb the energy in initial stage as well as in stage of crack propagation.

Keywords: dual phase steel, microstructural banding, energy absorption capacity

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Reference

- [1] http://www.autosteel.org/~media/Files/Autosteel/Research/Lightweighting/future_generation_passenger_compartment.ashx.org
- [2] KONIECZNY A.: On Formability Assessment of the Automotive Dual-Phase Steels, <https://shop.sae.org/technical/papers/2001-01-3075>
- [3] CHAKRABORTI, P.C., MITRA, M.K.: Microstructure and tensile properties of high strength duplex ferrite-martensite (DFM) steels, *Materials Science and Engineering A* 466 (2007) 123-133
- [4] MAZINANI, M., and POOLE, W.J.: Effect of Martensite Plasticity on the Deformation Behavior of a Low-Carbon Dual-Phase Steel, *Metall. Mater. Trans. A*, 38A (2007) 2 328-339
- [5] SUN, S., PUGH, M.: Properties of thermomechanically processed dual-phase steels containing fibrous martensite, *Materials Science and Engineering A* 335 (2002) 298-308
- [6] AVRAMOVIC-CINGARA, G., SALEH, Ch.A.R., JAIN, M.K. and WILKINSON, D.S.: Void Nucleation and Growth in Dual-Phase Steel 600 during Uniaxial Tensile Testing, *Metall. Trans. A*, 40A (2009) 12 3117- 3127
- [7] JUHAR, Ľ.: Influence of temperature-deformation conditions during rolling on multi-phase steels structure creation and their properties, *PhD Thesis*, Technical University in Košice, Košice 2009 (*in Slovak*)
- [8] VERHOEVEN, J. D.: A Review of Microsegregation Induced Banding Phenomena in Steels, *JMEPEG* 9 (2000) 3 286-296
- [9] CABALLERO, F.G., GARCÍA-JUNCEDA, A., CAPDEVILA, C. and GARCÍA de ANDRÉS, C.: Evolution of Microstructural Banding during the Manufacturing Process of Dual Phase Steels, *Materials Transactions*, 47 (2006) 9 2269 to 2276
- [10] YURIOKA, N.: Weldability calculation, <http://homepage3.nifty.com/yurioka/exp.html>. Accessed November 18 2008.XX
- [11] BURÍKOVA, K.: Microstructural nature of multiphase steels, PhD Thesis, Institute of Material Research, SAS in Košice, Košice 2009 (*in Slovak*)
- [12] DELINCÉ, M., BRÉCHET, Y., EMBURY, J.D., GEERS, M.G.D., JACQUES, P.J., PARDOEN, T.: Structure-property optimization of ultrafine-grained dual-phase steels using a microstructure-based strain hardening model, *Acta Materialia* 55 (2007) 2337-2350
- [13] BAG A., RAY, K., DWARAKADASA, E.S.: Influence of Martensite Content and Morphology on Tensile and Impact Properties of High-Martensite Dual-Phase Steels *Metall. Mater. Trans.* 30A (1999) 1193-1202

- [14] ROSENBERG, G.: The influence of grain size temperature and stress state on brittle fracture of steel, *Kovové materiály*, (1996) 4 201-216.

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