ADVANTAGES OF LASER SCANNING CONFOCAL MICROSCOPY IN MICROSTRUCTURE ANALYSIS OF TRIP STEEL

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KEY WORDS: Laser scanning confocal microscopy, TRIP steel, image analysis, thermo-mechanical treatment

Low alloyed transformation induced plasticity (TRIP) steels are multiphase steels with microstructure consisting of ferrite, bainite and retained austenite. Their good mechanical properties are influenced by so called TRIP effect, i.e. by the transformation of retained austenite to martensite during plastic deformation. An achievement of the optimal properties is conditioned by suitable volume fractions and morphologies of all phases and structural components, particularly retained austenite. Thermo-mechanical treatment (TMT) of TRIP steel with following chemical composition 0,26C-1,45Mn-1,32Al (weight %) was optimized in this work using TMT simulator. Commercial low alloyed TRIP steels usually contain from 1 to 2% of silicon. Higher silicon content in steel results in an improvement of mechanical properties, however it can cause problems with surface treatment, especially with galvanization. This is an important issue in an automotive industry, where most of the TRIP steel grades have been used. Silicon content has been therefore partially or totally substituted by aluminum, which possesses a similar influence on the stabilization of retained austenite as silicon without having its negative effect on surface quality. Consequently, convenient TMT of TRIP steels with aluminum should result in very similar phase fractions and mechanical properties as in the case of TRIP steels with silicon. An identification and quantification of phases, especially of retained austenite, is very important for the suitability evaluation of the individual TMT strategies with respect to the utilization of TRIP effect in resulted microstructure. Microstructures of processed specimens were in this work characterized with the use of light microscopy (LM), laser scanning confocal microscopy (LSCM) and image analysis. Scratch patterns were etched either in a common way by 3% Nital or by a two-step color etching consisting of a short dip in Nital and subsequent immersion in 10% aqueous solution of $Na_2S_2O_5$. The maximal magnification provided by LM is insufficient for a distinction of fine particles and thin films at grain boundaries or small islands in the very fine microstructures of TRIP steels. This is the reason why LSCM with the magnifications of up to 14400 was applied to the microstructure observation. Moreover LSCM possess two special imaging modes that enable 3D reconstruction of the etched surface of each specimen. It is therefore possible to identify the individual phases not only according to their appearance in the microscope, but also according to the surface relief, which depends on the intensity of etching. Powerful software accompanying LSCM also enables the use of some image analysis operations. In addition to the above-mentioned advantages of LSCM, a scratch patterns preparation for LSCM corresponds to the preparation procedure for LM and doesn't require any special equipment or treatment.

Acknowledgements: This paper includes results obtained within the project 1M06032 Research Centre of Forming Technology.