IMPROVING FORMABILITY AND CRASH PERFORMANCE OF COLD WORKED STEELS USING LOCAL LASER HEAT TREATMENT

Motivation

Political and economic demands to converse resources, to use energy more efficient and to reduce the CO₂ footprint aggravate the requirement for new lightweight concepts. Cold worked ferritic steels (e. g. IF steels, micro alloyed steels) hold the potential for this. However, these steels are usually annealed after cold working to improve their formability and thus the lightweight potential cannot be fully utilized. A local heat treatment, which softens the material in areas, which require a high degree of forming, can be a solution. Moreover, the local heat treatment can be used to integrate soft areas in a part, which enhance the crash performance by forcing the material to deform in a certain way under dynamic load.

Approach

An innovative approach is pursued in a collaboration project of the Institut für Bildsame Formgebung of RWTH Aachen University and the Fraunhofer-Institut für Lasertechnik called “Local Laser Heat Treatment of Cold Worked Steels to Improve Formability and Functionality” (AiF: FK 18845 N).

For sheets of low-alloyed steels, tailored properties for forming operations and crash performance will be adjusted by a combination of cold rolling and local heat treatment. The work hardening is eliminated partly or completely by thermal induced processes like crystal recovery or recrystallization. In parameter studies the correlation between time-temperature-profiles and resulting microstructure and mechanical properties will be investigated.

In the next step forming tests and crash tests will be performed. Additionally the effect of the laser heat treatment on the corrosion properties will be investigated. For the transfer of this technology into industrial production it is necessary to implement the local mechanical properties into simulation of forming operation and crash performance, to identify the regions, which have to be softened and to evaluate the effect of softening. In close cooperation with the industrial board members, concepts will be developed where laser softening can be integrated in the process chain of metal sheet forming.

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