Precise material data for high-strength steels: Efficient design of forming processes

About this project

effiTEST

Precise material data for high-strength steels: Efficient design of forming processes

Markets:

Material: Steel

This project is funded by the Technology Transfer Programme Leichtbau (TTP LB) of the Federal Ministry of Economics and Energy.

Technology Transfer Program Leichtbau

Precise material data for high-strength steels: Efficient design of forming processes

About this project

Context

The automotive industry is facing the challenge of making vehicles lighter, more efficient and more climate-friendly. Body construction plays a central role in this: large quantities of sheet metal components are processed here - often from high-strength steel materials. Although lightweight alternatives such as aluminium or fibre composites are increasingly being used, steel continues to dominate, especially in models with large production volumes. It is cost-effective, easy to recycle and mechanically reliable.

At the same time, it presents challenges: its complex microstructure requires special forming processes - and precise material data. The characteristic values commonly used to date are not sufficient for this. Due to the lack of reliable data, safety margins are used in many manufacturing processes - which leads to increased material and energy consumption. Added to this are production errors such as edge cracks or uncontrolled deformations. In view of the millions of car body components produced each year, these deficits not only cause avoidable costs, but also unnecessary CO# emissions.

In order to fully exploit the potential of modern steels in lightweight construction, new ways are therefore needed to characterise their forming properties in a process-related and reproducible manner. The effiTEST project team aims to close this gap.

Purpose

The researchers are developing a testing machine with which two key characteristics of high-strength steels can be determined objectively and under realistic conditions: edge crack sensitivity during cold forming and the forming limit curve at temperatures above 700 °C for hot forming. The edge crack sensitivity describes how easily a sheet metal tears at cut edges during forming; the forming limit curve indicates how much a material can be formed before it fails. In this way, the project team is creating a basis for reliable component design and precise process control. The aim is to avoid typical faults such as necking or cracks - and to utilise the full potential of the material.

With the new testing machine, the participants combine both processes in one system. It reproduces real process conditions, for example through reproducible temperature control, practical forming speeds and automated crack detection. The team intends to use the data obtained directly for numerical component design, the optimisation of blank cuts and the monitoring of series production. In this way, effiTEST helps to save material, energy and CO# - and to sustainably improve the efficiency of production in car body construction.

Precise material data for high-strength steels: Efficient design of forming processes

About this project

Procedure

The project team is combining two previously separate test methods into a single system. For cold forming, they are expanding the hole expansion test to include pneumatic crack detection: in future, a pressure sensor will decide when a crack has occurred instead of by sight. This ensures objective and reproducible results - even in series production. For hot forming, the researchers are integrating inductive heating, with which only the relevant test area can be heated to over 700 °C. The heating takes place directly in the test area. The heating takes place directly in the test bench so that heat loss through transport is avoided.

The researchers are also integrating a flexible drive system into the test facility that realistically simulates typical pressing movements. A modular design allows quick changes between the processes. An optical measuring system records the forming speed and pyrometers monitor the temperature. All relevant process data is fed into the machine control system.

Based on the test results, the researchers check the processes and prepare their industrial application. They are also incorporating the findings into standardisation processes - so that the testing technology developed can be widely used in industry in the future, not just in the laboratory.

Precise material data for high-strength steels: Efficient design of forming processes

About this project

Funding duration:

Funding sign:	03LB5003	**Funding amount:**	EUR 633 thousand

Final report

Further websites foerderportal.bund.de/foekat/jsp/SucheAction.do?actionMode=view&fkz=03LB5003A - effiTEST in the federal funding catalogue

Precise material data for high-strength steels: Efficient design of forming processes

Project coordination

Contact:

Mr Dr.-Ing. Alexander Hobt

+49 07371 9302-37

hobt@formtest.de

Organisation:

FORM+TEST Seidner&Co. GmbH

Zwiefalter Str. 20
88499 Riedlingen
Baden-Württemberg
Germany

www.formtest.de

English (EN){{ Projektpartner }}

Precise material data for high-strength steels: Efficient design of forming processes

Lightweighting classification

	Realisation
Offer	
Products Semi-finished parts, Machines and plants, Software & databases, Systems and end products, Materials	✓
Services & consulting Consulting, Testing and trials, Engineering, Standardisation, Prototyping, Validation	✓
Field of technology	
Design & layout Lightweight manufacturing, Lightweight material construction	✓
Functional integration Actuator technology, Sensor technology	✓
Measuring and testing technology Materials analysis, Destructive analysis, Non-destructive analysis	✓
Modelling and simulation Crash behaviour, Life-cycle analysis, Optimisation, Processes, Structural mechanics, Materials	✓
Plant construction & automation Plant construction, Automation technology	✓
Recycling technologies	

Precise material data for high-strength steels: Efficient design of forming processes

Lightweighting classification

	Realisation
Manufacturing process	
Additive manufacturing	
Coating (surface engineering)	
Fibre composite technology	
Forming Stretch forming, Deep-drawing	✓
Joining	
Material property alteration Thermomechanical treatment	✓
Primary forming	
Processing and separating Cutting	✓
Textile technology	
Material	
Biogenic materials	
Cellular materials (foam materials)	
Composites	
Fibres	
Functional materials	
Metals Steel	✓
Plastics	
Structural ceramics	
(Technical) textiles	