

# Tailoring materials properties for flexibilisation of manufacturing processes and process chains

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## Abstract

Global trends towards CO<sub>2</sub> reduction and resource efficiency have significantly increased the importance of lightweight design in modern car body manufacturing and manufacturing processes in general. Therefore, especially the implementation of high strength steels and modern lightweight materials such as aluminum alloys gained importance in recent years. Because the formability of these materials is poor, conventional processes reach their limits. In addition, automotive manufacturers are facing new problems due to rising decentralized production with regional distinctions, increasing number of vehicle-derivates and ever-shorter production cycles. As a consequence, the flexibility and adaptability of production processes will be the key asset for competitiveness in the automotive industry. This implies not only, for example, the manufacturing of high-strength components, such as a B-pillar, by a warm forming process instead of a conventional cold forming operation in order to enhance the forming limits. In fact, the core idea is a comprehensive analysis of the whole production chain, taking into account all steps of it and adapt material and process characteristics according to it. One approach is the modification of the material's properties for subsequent forming and joining processes as well as to meet required in-service behavior of the parts, the so-called tailoring. Tailored blanks enable a flexibilisation of the manufacturing process by locally changing the mechanical properties in order to enhance the forming limits or to adjust the properties for the specific application. Within this contribution, different methods for tailoring the material properties are presented and their potential for achieving versatility in modern manufacturing technology will be discussed.

## Biography of Presenting Author



### EDUCATION

26/07/2006 Habilitation (Dr.-Ing. habil.) with Venia Legendi in production technology Faculty of Engineering / Friedrich-Alexander-University Erlangen-Nürnberg / Institute of Manufacturing Technology (LFT) / Germany “Characterisation of Sheet Metals for Light Weight Constructions”

28/05/2001 PhD of Mechanical Engineering Faculty of Engineering / Friedrich-Alexander-University Erlangen-Nürnberg / Institute of Manufacturing Technology (LFT) / Germany “Laser forming of aluminium alloys - influencing of microstructure and mechanical properties”

25/09/1997 Diploma in Material Science Faculty of Engineering / Friedrich-Alexander-University Erlangen-Nürnberg / Germany “Cyclic

work hardening and fatigue behaviour of metals at temperatures between -100 °C and +150 °C”

### AFFILIATIONS

Since 2008 Professor of Manufacturing Technology (W3)

Faculty of Engineering / Maschinenbau / Friedrich-Alexander-University Erlangen-Nürnberg / Institute of Manufacturing Technology (LFT) / Germany

2001 – 2008 Senior manager for sheet metal forming

Faculty of Engineering / Friedrich-Alexander-University Erlangen-Nürnberg / Institute of Manufacturing Technology / Germany

### INSTITUTIONAL RESPONSIBILITIES

2017 - 2019 Head of Department Mechanical Engineering

Faculty of Engineering / Friedrich-Alexander-University Erlangen-Nürnberg /

2011 - 2015 Dean

Faculty of Engineering / Friedrich-Alexander-University Erlangen-Nürnberg /

2010 – 2011 Vice-Dean

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### AWARDS

2018 Bayerischer Verdienstorden

2017 25-Frauen-Award of Edition F

2013 Gottfried Wilhelm Leibniz Award from the DFG / Germany

2009 SAE/AISI Sydney H. Melbourne Award for Excellence in the Advancement of Automotive Sheet Steel / USA

2007 Otto-Kienzle Medal of the German Academic Society for Production Engineering (WGP) / Germany

2006 Ring of Honor received from the German Society of Engineers (VDI) / Germany

2004 Heinz-Maier-Leibnitz Award received from the German Research Society (DFG) / Germany

2002 Dissertation Award received from Faculty of Engineering of FAU / Germany

## **LECTURE**

*Since 2008* Professor – Production technology and Forming technology  
*2011, 2015* Coordination of SMART Summer School

## **ORGANISATION OF SCIENTIFIC COLLABORATIONS**

*Since 2019* Coordinator of the Transregional collaborative research center on mechanical joining (TR285)

*Since 2009* Coordinator of the Transregional collaborative research center on sheet-bulk metal forming (TR73)

*2006-2011* Coordinator of the research group DFG FOR552 on fundamentals of hot stamping /

## **ORGANISATION OF INTERNATIONAL CONFERENCES**

*Since 2008* Workshop Hot stamping

*2015* SheMet

*2013 - 2014* WGP Congress

*2013* Esaform

## **COMMISSIONS OF TRUST**

Member of editorial board

*Since 2012* Journal of Materials Processing and Technology

*Since 2012* Production Engineering - Research and Development

*Since 2014* Editor of Journal Production Engineering - Research and Development

*Since 2018* Associate Editor of Journal of Materials Processing Technology

## **MEMBERSHIPS OF SCIENTIFIC SOCIETIES**

*Since 2019* Senator, German Research Foundation (DFG)

*Since 2015* Fellow, CIRP International Academy for Production Engineering (CIRP)

*2009 - 2015* Associate Member, International Academy for Production Engineering (CIRP)

*Since 2015* Member of acatech, BBAW and Leopoldina

*Since 2012* Member, German Academic Society for Production Engineering (WGP)

*2001 – 2010* Member, DFG Collaborative Research Center (SFB) 396

*Since 2008* Elected Member, German Forming Society (AGU)

*Since 2001* Applicant of grants, German Research Foundation (DFG)

## **INTERNATIONAL COLLABORATIONS**

Different universities worldwide, e.g. TU Graz, IIT India, University of Stockholm, University of Deakin, University of Palermo and others within CIRP

## **PATENTS**

7 patents

## **PUBLICATIONS**

Publication Summary

Total Citations from Database Scopus: 4711

H index from SCOPUS lists: 30

Total number of publications within SCOPUS: 451

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Journal of Materials Processing Technology Special Issue 228 On Hot Stamping

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