Laboratory for material
and joining technology

PADERBORN
UNIVERSITY

PADERBORN, 1 - 3 April 2025

21th International Conference on Sheet Metal SheMet 2025

Welcome to the 21st International Conference on Sheet Metal!

The conference is hosted by the
Laboratory for material and joining technology (LWF)
at the Paderborn University.

Freundeskreis LWF Universität Paderborn e.V.

We wish you a nice stay in Paderborn including interesting discussions and knowledge exchange during the conference!

Preface

The SheMet Conference, which addresses current research and development topics in the field of sheet metal processing, is held every two years and takes place for the 21st time in 2025. It is hosted by the Laboratory for material and joining technology (LWF) for the first time. For this reason, I am particularly pleased to welcome numerous participants in Paderborn, which provides us with the opportunity to share new knowledge and advance our collaborative research efforts. The conference serves as a vital platform for fostering interdisciplinary dialogue between researchers, industry experts, and young scientists. In addition to the technical sessions, participants can look forward to engaging in networking opportunities and stimulating discussions.

The conference provides an interdisciplinary forum that brings together scientists and industry professionals from around the world. It offers a valuable opportunity to exchange and consolidate the latest research findings across disciplines such as materials science, manufacturing engineering, and digitalisation. A key thematic area is joining by forming, which plays a decisive role in the development of future-oriented joining technologies, both with and without auxiliary elements. As demands for lightweight and multi-material structures increase, innovative joining solutions become increasingly indispensable. This research makes a significant contribution to efficient and sustainable production, occupying a central place in the conference program. Closely related are material characterisation and modelling, which form the scientific basis for understanding and optimising many manufacturing processes. Simulation and predictive modelling are particularly relevant for modern, digitalised production. The conference also addresses the essential fields of sheet metal processing, including incremental forming, which enables flexible and tool-independent production of complex geometries. In addition, the integration of machine learning is gaining momentum, offering new potential for process optimization, predictive maintenance, and quality assurance. Another focus lies on the use of polymers and composites, which provide lightweight alternatives and expand the material spectrum for advanced applications. Welding and additive manufacturing are also featured prominently, representing key technologies for customized production and repair processes. Sustainability, as a cross-cutting issue, is highlighted through contributions emphasizing resource efficiency, reduced emissions, and circular design strategies. Together, these topics provide a comprehensive overview of current innovations and promote interdisciplinary collaboration in the evolving field of sheet metal and materials processing.
I want to thank everyone who made SheMet 2025 possible. I want to extend my sincere appreciation to all authors, presenters, keynote speakers, and the Scientific Committee for their valuable contributions and support. I look forward to inspiring discussions and wish all participants a rewarding and memorable stay in Paderborn.

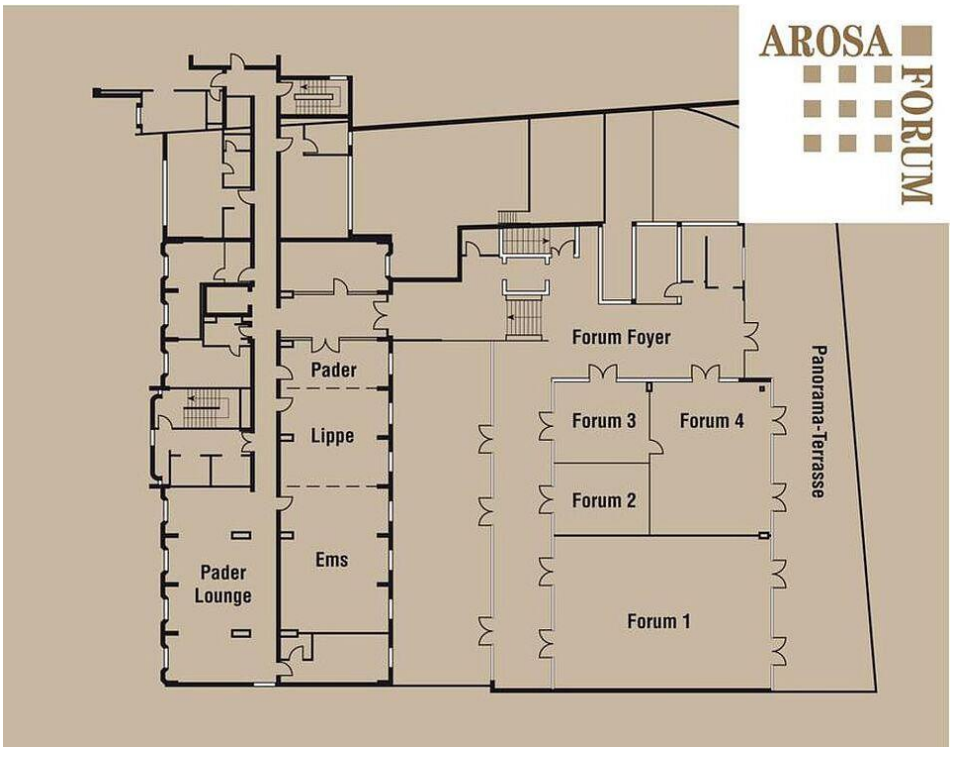
Prof. Dr.-Ing. G. Meschut
Chairperson, Organizing Committee
April 2025

Location and conference rooms

The sessions will take place at the Best Western Plus Arosa Hotel near the „Paderborner Dom“ right in the center of Paderborn City. The „Kaiserpfals“, the Pader springs and the Paderborner Dom are in comfortable walking distance.

Westernmauer 38,
33098 Paderborn

Program item	Room
Registration	Forum Foyer
Parallel sessions	Forum 1
	Forum 2-4
Coffee breaks and lunch	Forum Foyer



Overview

Conference day	Program item	Time	Location
Mon, 31 Mar 2025	Welcome reception	06:00 PM	①
Tue, 1 Apr 2025	Registration	08:30 AM	②
	Conference day 1	09:00 AM	②
	Social Program		
	• Heinz Nixdorf MuseumsForum	06:30 PM	③
	• Night watchman tour through Paderborn Center	06:30 PM	④
Wed, 2 Apr 2025	Conference day 2	09:00 AM	②
	Conference dinner	07:00 PM	⑤
Thu, 5 Apr 2023	Conference day 3	09:00 AM	②

① **Paderborner Brauhaus**
Kisau 2,
33098 Paderborn

② **Best Western Plus Arosa Hotel**
Westernmauer 38,
33098 Paderborn

③ **Heinz Nixdorf MuseumsForum**
Fürstenallee 7,
33102 Paderborn

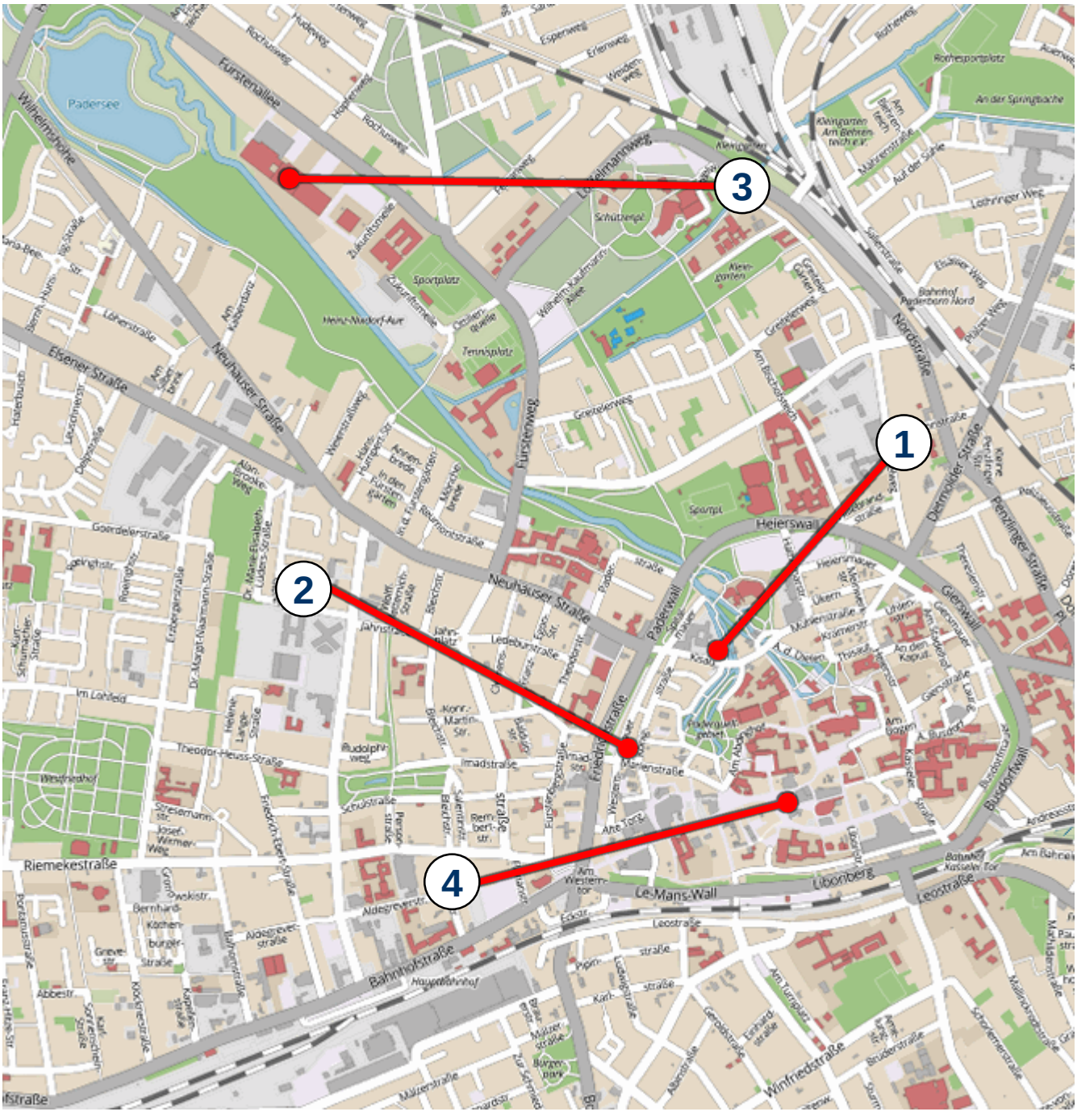
④ **Rathaus Paderborn**
Rathausplatz 1,
33098 Paderborn

⑤ **Hangar II**
Flughafenstr 33,
33142 Büren
Bushuttle from ① to ④


Rathaus Paderborn


Night watchman tour

City map of Paderborn



Keynotes

The Performance and Potential of Sheet Metal Working in a Circular Economy

Prof. Dr. ir. Joost Duflou
KU Leuven

In a society that emphasizes resource efficiency and aims for circularity with growing attention, the performance and possible contributions of sheet metal working processes are relevant to consider. In this lecture the footprint of sheet metal working processes and the performance of the resulting sheet metal parts will be critically assessed and compared to other process categories. The potential of sheet metal scrap to be efficiently recycled and the possible role of forming processes in well-optimized recycling routes in an industrial symbiosis context will be explored.

Sustainable Steel Production and Application

Amalia Koletti
thyssenkrupp Steel Europe AG

The steel industry is on a transformative journey towards achieving net-zero emissions by 2045, with thyssenkrupp Steel Europe leading the way through the development of hydrogen-based steel production to significantly reduce CO2 emissions. Since steel is one of the most important materials for automotive production, the decarbonization of the steel industry is crucial for the reduction of Scope 3 upstream emissions in the automotive supply chain. Besides the reduction of emissions during steel production, significant emission reductions can be achieved during its use phase by lightweight steel applications using advanced high-strength steels (AHSS). These types of steels enable weight reduction, which in turn lowers CO2 emissions. By optimizing both the production and the application of steel, the industry can make substantial strides towards sustainability and environmental performance.

Keynotes

Challenges to Sheet Metal Forming Technology Brought by Development of Electric Vehicle Industry

SHENGXIANG LIU
Company NIO Technology (Anhui) Co., Ltd.

Rapid growth of electric vehicles has intensified the competitive situation in the industry, and has put forward unprecedented requirements for lightweight, multifunctionality, strict cost control, and rapid iteration in body design and manufacturing. It has become a key indicator for measuring the quality of electric vehicle bodies. As a fundamental pillar of vehicle manufacturing, sheet metal forming technology is encountering unprecedented challenges. This report provides an in-depth analysis of six major challenges: 1. Reducing the production cycle for long-lead-time components, particularly side panels; 2. Adapting flexibly to rapid product iterations; 3. Achieving lightweight and complex features; 4. Overcoming difficulties in ultra-deep drawing processes; 5. Efficiently integrating new materials such as aluminum sheets, high-strength steel, and ultra-high-strength steel. To address these challenges, the report proposes three key strategies: 1. Enhancing dimensional accuracy control in sheet metal forming;2. Optimizing forming technologies for complex features; 3. Improving surface defect detection and elimination mechanisms. Looking ahead to the future, sheet metal forming technology will continue to evolve and innovate, helping electric vehicles create lighter, smarter, and more sustainable electric vehicle solutions.

Taking Autonomous Driving from vision to reality

Dr.-Ing. Christian Schübeler Dr.-Ing. Tino Fuhrmann,
VOLKSWAGEN AG

We are currently experiencing new digitization solutions in various areas. In the course of this, new types of assistance systems up to autonomous driving are being developed in the automotive sector. This also opens up new perspectives for future mobility models such as a driverless fleets for ride pooling or hailing in urban conurbations.
This development is illustrated by the ID.Buzz AD project. In addition to hardware and software development, a central challenge is to validate the digital driver for operation on public roads and to issue the approvals and also to gain the acceptance of the population for this technology.
In the outlook, we derive open questions regarding the basic vehicle structures and joining technology, which result from the usage profiles of autonomous vehicle operation.

Keynotes

Next-Generation Hot Forming of Titanium Alloys: Process Innovations for the Aerospace Industry

Jan Wesendahl
HEGGEMANN AG

The aerospace industry is experiencing continuous growth, driving increasing demands on innovations in manufacturing technologies. Titanium alloys play a crucial role in modern aircraft structures due to their outstanding properties. At the same time, there is a growing need for cost-efficient and resource-conscious production methods to meet rising performance and economic requirements.
This keynote presents two innovative hot forming processes for titanium alloys: isothermal deep drawing, which ensures excellent part quality through precise temperature control and controlled forming processes, and hot stamping of titanium alloys, which enables targeted optimization of material properties during forming. Both processes hold significant potential for cost-effective serial production in the aerospace industry.
The Keynote concludes with practical application examples, demonstrating the successful implementation of these technologies in a small and medium-sized enterprise (SME). These case studies highlight the vast potential of advanced hot forming processes for the future production of high-performance titanium components.

Program

Monday, 31 March 2025

18:00	**Welcome reception**

Tuesday, 01 April 2025 (morning)

8:30	**Registration**	
9:00	**Opening ceremony** Forum 1	
9:20	**Keynote: Volkswagen AG** Taking Autonomous Driving from vision to reality *Tino Fuhrmann, Christian Schübeler* Forum 1	
9:50	**Change to sessions**	
	Forming Chair: Prof. J. Allwood Forum 1	**Simulation** Chair: Prof. G. Kullmer Forum 2-4
10:10	Folding Pre-shaped Blanks *David Evans and Julian Allwood*	A Novel Hybrid Hot Forming Process Concept for High Strength Aluminum Alloys *Naveen Krishna Baru, Tobias Teeuwen, David Bailly and Emad Scharifi*
10:35	A first approach towards in-line shape monitoring and control in flexible roll forming automotive components *Abdelrahman Essa, Buddhika Abeyrathna, Bernard Rolfe, Li Yu and Matthias Weiss*	Modeling of notch effects due to multi-material joints in automotive body components for crash applications *Philipp Bähr, Silke Sommer and Gerson Meschut*
11:00	A Study of Beak Geometries for Achieving Pure Shear Deformation in Folding-Shearing *Rishabh Arora, Omer Music and Julian Allwood*	Cross-Process Damage Modeling: A Process-Chain Case Study of Clinching and Self-Pierced Riveting for Aluminum Connections *Özcan Harabati, Christian Roman Bielak, Max Böhnke, Malte Christian Schlichter, Marc Brockmeier, Mathias Bobbert and Gerson Meschut*
11:25	Experimental Investigations on a Process Adapted Material Testing Method for Hydroforming of Tubular Components *Jonas Reblitz and Marion Merklein*	Numerical and experimental investigation on full backward extrusion process in forming of pins from DC04 coil *Keyu Luo, Marion Vogel and Marion Merklein*
11:50	**Lunch**	

Program

Tuesday, 01 April 2025 (afternoon)

13:00	**Keynote: thyssenkrupp Steel Europe AG** Sustainable Steel Production and Application *Amalia Koletti, Fabian Botz and Thomas Flöth* Forum 1	
13:30	**Change to sessions**	
	Incremental forming Chair: Prof. H. Hagenah Forum 1	**Machine learning** Chair: Prof. A. Brosius Forum 2-4
13:40	Supporting toolpath generation for double sided incremental forming of polyhedron parts *Hans Vanhove, Arnoud Van Hees and Joost Duflou*	Impact of the Parameter Distribution on the Predictive Quality of Metamodels for Clinch Joint Properties *Jonathan-Markus Einwag, Stefan Goetz, Sandro Wartzack and Yannik Mayer*
14:05	Revisiting Formability Limits in Incremental Sheet Forming *Margarida Gralha, Bernardo Colaço, João Pedro Magrinho, Énio Chambel and M. Beatriz Silva*	Transient Dynamic Analysis: Performance Evaluation of Tactile Measurement *Gregor Reschke and Alexander Brosius*
14:30	SPIF accuracy improvement by FEM analysis of multi-step tool trajectories with experimental validation *Cristian Cappellini, Claudio Giardini and Sara Bocchi*	Predicting and Identifying Factors Affecting Sheet Metal Bending Times Using Explainable AI *Alp Bayar, Johan Joubert and Joost R. Duflou*
14:55	Investigating intermediate shapes for multi-stage forming of cranial implants: the influence of two intermediates stages *Marthe Vanhulst and Joost R. Duflou*	ML modeling of a deep drawing process for predicting resulting component properties after springback *Jonas Neumann, Umang Bharatkumar Ramaiya and Marion Merklein*
15:20	**Coffee break**	
	Joining Chair: Prof. M. Merklein Forum 1	
15:30	SE Analysis as a Tool for Forming and Medical Technology *Sinan Yarcu, Bernd-Arno Behrens, Sven Huebner and Serdar Yalcin*	
15:55	In situ Computed Tomography – Analysis of Settling Effects During Single-Lap Shear Tests with Clinch Points *Daniel Köhler, Juliane Troschitz, Robert Kupfer and Maik Gude*	
16:20	Investigation on manufacturing-induced pre-deformation on the fatigue behaviour of clinched joints *Malte Christian Schlichter, Özcan Harabati, Max Böhnke, Christian Roman Bielak, Mathias Bobbert and Gerson Meschut*	
16:45	**End of sessions**	
18:30	**Evening event**	

Program

Wednesday, 02 April 2025 (morning)

9:00	**Keynote: NIO Technology (Anhui) Co., Ltd.** Challenges to Sheet Metal Forming Technology Brought by Development of Electric Vehicle Industry *Shengxiang Liu* Forum 1	
9:30	**Change to sessions**	
	Characterization Chair: Prof. J. Magrinho Forum 1	**Polymers and composites** Chair: Prof. G. Meschut Forum 2-4
9:40	Evaluating the joinability of aluminium 2024 T351 for aerospace structures using aluminium solid self-piercing rivets *Felix Holleitner, Knuth-Michael Henkel and Normen Fuchs*	Joining process for fiber-reinforced thermoplastics and sheetmetal without additional adhesion promoter *Jörn Wehmeyer, Bernd-Arno Behrens, Sven Hübner and Annika Raatz*
10:05	Influence of the sampling procedure on the mechanical forming limits in the characterization of sheet metal foils *Jan Sommer, Max Meerkamp, Martina Müller, Tim Herrig and Thomas Bergs*	Efficient Failure Information Propagation under Complex Stress States in Fiber Reinforced Polymers: From Micro- to Meso-scale using Machine Learning *Johannes Gerritzen, Andreas Hornig and Maik Gude*
10:30	Processing of the hypoeutectic AlSi9 alloy with Twin-roll casting by using copper shells *Moritz Neuser, Kay-Peter Hoyer and Mirko Schaper*	Modeling approaches for the decomposition behavior of preconsolidated rovings throughout local deformation processes *Benjamin Gröger, Johannes Gerritzen and Maik Gude*
10:55	The Effect of Height to Diameter Ratio at Stack Compression Tests on Biaxial Yield Stress *Martin László Kölüs and Gábor József Béres*	Combination of metal forming and injection moulding in one tool *Juliane Troschitz, Sven Bräunling, Matthias Kahl, Frank Schneider, Thomas Krampitz, Robert Kupfer, Maik Gude and Alexander Brosius*
11:20	**Coffee break**	
	Welding and additive manufacturing Chair: Prof. F. Micari Forum 1	**Simulation** Chair: Dr.-Ing. M. Bobbert Forum 2-4
11:40	Influence of Liquid metal embrittlement on load-bearing capacity of resistance spot welds under crash loads: A study based on S-Rail Components *Keke Yang, Max Biegler, Linus Happe, Marius Striewe, Viktoria Olfert, David Hein, Michael Rethmeier and Gerson Meschut*	Modelling Strategies for Non-Rotationally Symmetric Joints *Deekshith Reddy Devulapally and Thomas Tröster*
12:05	Joining by forming of hybrid busbars using wire-arc additive manufactured rivets *João P.M. Pragana, Rui F.V. Sampaio, Ivo M.F. Bragança, Carlos M.A. Silva and Paulo A.F. Martins*	Influence of thermal effects on clinch joining of sheet metal *Johannes Friedlein, Paul Steinmann and Julia Mergheim*
12:30	A numerical model to study the temperature and residual stress profiles in hybrid additive manufacturing *Gaetano Pollara, Dina Palmeri, Gianluca Buffa and Livan Fratini*	High-Cycle Fatigue Testing and Parameter identification for Numerical Simulation of Aluminum Alloy EN AW-6014 *Chin Chen, Malte Christian Schlichter, Sven Harzheim, Martin Hofmann, Mathias Bobbert, Gerson Meschut and Thomas Wallmersperger*
13:00	**Lunch**	

Program

Wednesday, 02 April 2025 (afternoon)

14:00	**Keynote: Heggemann AG** Next-Generation Hot Forming of Titanium Alloys: Process Innovations for the Aerospace Industry *Jan Wesendahl* Forum 1
14:30	**Change to sessions**
	Forming
14:40	**Characterization** Chair: Prof. B. Silva Forum 1
15:05	Consideration of residual stresses and damage in the fracture mechanical investigation of mechanically joined structures *Deborah Weiß, Tobias Duffe, Tintu David Joy and Gunter Kullmer*
15:30	Inverse parameter identification for the delamination behaviour of metal-polymer-metal sandwich materials *Moritz Kuhtz, Jonas Richter, Andreas Hornig and Maik Gude*
15:55	A Dieless Nakajima Test for Additively Deposited Materials *Rui F.V. Sampaio, Pedro M.S. Rosado, João P.M. Pragana, Ivo M.F. Bragança, Chris V. Nielsen, Carlos M.A. Silva and Paulo A.F. Martins*
	Coffee break
16:05	**Forming** Chair: Prof. B.-A. Behrens Forum 1
16:30	Cost-effective repair solution for Twin-Roll-Caster rollers *Martin Lauth, Kay-Peter Hoyer, Mirko Schaper and Winfried Graefen*
16:55	**End of sessions**
19:00	**Conference dinner**

Program

Thursday, 03 April 2025 (morning)

9:00	**Keynote: KU Leuven** The Performance and Potential of Sheet Metal Working in a Circular Economy *Prof. Dr. ir. Joost Duflou* Forum 1	
9:30	**Change to sessions**	
	Sustainability Chair: Prof. J. Duflou Forum 1	**Welding and additive manufacturing** Chair: Prof. H. C. Schmale Forum 2-4
9:40	The assessment of heavy-duty laser cutting efficiency and environmental impact through different optical setup *Masoud Kardan, Brent Hendrickx and Joost R. Duflou*	Effect of Process Parameters on Local Thickening of Mg-Zn-Zr Alloy Sheets in TIG Welding *Ecem Ozden, Oleksandr Kurtov, Hans Vanhove and Joost R. Duflou*
10:05	Experimental Analyses of Lubricant Reduction in an Industrial Progressive Tool *Eugen Stockburger, Leonard Kürbis and Margarethe Nickel*	Local adaptation of aluminum blanks through laser de-alloying and wire alloying *Marcel Stephan, Henrik Zieroth, Simona Samland, Dominic Bartels, Marion Merklein and Michael Schmidt*
10:30	**Coffee break**	
	Joining Chair: Prof. G. Meschut Forum 1	
10:40	Investigation failure behavior in the shear tensile test with respect to the arrangements of clinched joints Eugen Wolf and Alexander Brosius	
11:05	Non-destructive testing in versatile joining processes *Michael Lechner, Thomas Borgert, Matthias Busch, Arnold Harms, Pia Holtkamp, Fabian Kappe, David Römisch and Simon Wituschek*	
11:30	Analysis of the binding mechanisms depending on versatile process variants of self-piercing riveting *Stephan Lüder, Pia Katharina Holtkamp, Simon Wituschek, Mathias Bobbert, Gerson Meschut, Michael Lechner and Hans Christian Schmale*	
12:00	**Conference closure**	
12:20	**Lunch**	
15:00	**End of Conference**	

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