

Table of Contents

Preface

Committees

Sponsors

Acknowledgements

I. Keynote

Manufacturing of Innovative Car Seat Components by Forming of Advanced High Strength Steels – Fundamental Research and Application

M. Merklein and M. Kaupper

3

II. Hydroforming

Experimental Study of Lubrication Influence in the Production of Hydroformed T-Joint Tubes

A. Fiorentino, E. Ceretti, A. Aldo, D. Braga and C. Giardini

15

Feasibility Evaluation of Sheet Metal Hydroformed Components through Shape Factors Application

A. Del Prete, T. Primo, G. Papadia and B. Manisi

25

Multifunctional Lightweight Structures from Tailored Cladded Blanks

W. Homberg, A.E. Tekkaya, C. Beerwald, A. Brosius, J. Dau and M. Trompeter

37

Process Performances Evaluation Using a Specific Shape Factor in the Case of Sheet Hydroforming

A. Del Prete, G. Papadia and A. Anglani

43

Hydroforming of Large-Area Multi-Cell Sheet Metal Structures

M. Trompeter, B. Rauscher, H. Karbasian, A.E. Tekkaya and W. Homberg

53

Mechanical Behaviour of Ceramic Beads Used as Medium for Hydroforming at Elevated Temperatures

M. Merklein and M. Grüner

61

Hydroforming of Laser Welded Sheet Stringers

M. Ertugrul and P. Groche

69

III. Joining

Aluminium Alloy Self-Pierce Riveting for Joining of Aluminium Alloy Sheets

Y. Abe, T. Kato and K. Mori

79

Yb:YAG Disc Laser Welding of Austenitic Stainless Steel Without Filler Material

M. Keskitalo and K. Mäntyjärvi

87

Aluminum Alloy Tube Welding by Means of High Power Diode Laser

F. Quadrini, E.A. Squeo and V. Tagliaferri

97

Advanced Joining Technologies for Aluminium Assembly for the Automotive Industry

L. Han, K.W. Young, R. Hewitt, N. Blundel and M. Thornton

105

Stability of Friction Stir Welds at Superplastic Forming Temperatures

T. Minton and J. Au

117

Optimising the Design of Adhesively Bonded Joints

I. Pearson

127

IV. Manufacturing Systems

Tool Path Generation for Free Form Surfaces in Robot-Based Incremental Sheet Metal Forming	
H. Meier, J. Brüninghaus, B. Buff, A. Hypki, A. Schyja and V. Smukala	143
Design of Lean Manufacturing Support Systems in Make-to-Order Production	
D.T. Matt	151
Robot-Based Incremental Sheet Metal Forming – Increasing the Part Accuracy in an Automated, Industrial Forming Cell	
H. Meier, B. Buff and V. Smukala	159

V. Micro Technologies

Enhanced Formability of Ultrafine-Grained Aluminum Blanks by Local Heat Treatments	
M. Merklein and U. Vogt	169
A Study of High Temperature Viscoplastic Deformation of Beta Titanium Alloy Considering Yield-Point Phenomena	
X.T. Wang, H. Hamasaki, M. Yamamura, R. Yamauchi, T. Maeda, Y. Shirai and F. Yoshida	177
Application of the Micro-Tensile Testing to Investigate the Adhesion of Thermal Oxide Scales Grown on AISI 441 Stainless Steel Sheet Oxidised in Air and Water Vapour	
S. Chandra-Ambhorn, T. Nilsonthi, Y. Madi and A. Galerie	187

VI. Quality/Surface Conditioning

Subtle Cosmetic Defects in Automotive Skin Panels	
S. Hazra, D.K. Williams, R. Roy, R. Aylmore and A. Smith	197
Monitoring of CO₂ Laser Cutting of Thick Steel Plates by Means of a NIR Camera Based System	
E. Fallahi Sichani, J. De Keuster, J.P. Kruth and J.R. Duflou	207
Investigation of the Mechanical Behavior of a PU-Based Coil-Coating System with the Help of Indentation and FE Analysis	
B.A. Behrens, H.H. Gatzen, I. Peshekhodov and F. Pape	217

VII. Tooling

Automating the Design of Cold Roll Forming Roll Sets	
D.J. Mynors, M. English and M. Castellucci	227
Wear Analysis during Friction Stir Processing of A359+20%SiC MMC	
D. Contorno, M.G. Faga, L. Fratini, L. Settineri and G. Gautier di Confienço	235
Roll Forming: Reusable Design and Quantifiable Design Effectiveness	
D.J. Mynors, M. English and M. Castellucci	245

VIII. Stamping

Prevention of Oxidation in Hot Stamping of Ultra High Strength Steel Sheets	
K. Mori, S. Maki and S. Saito	255
Process Variables Optimisation of Polypropylene Based Fibre-Metal Laminates Forming Using Finite Element Analysis	
S. DharMalingam, P. Compston and S. Kalyanasundaram	263
Optimisation of the Stamping Processes for a Drawn-Part Made of Aluminium	
P. Lacki	271
Stamping of Titanium Sheets	
J. Adamus	279
Investigation of the High Strength Steel Al-Si Coating during Hot Stamping Operations	
F. Borsetto, A. Ghiotti and S. Bruschi	289
Interlaboratory Comparison of Forming Limit Curves for Hot Stamping of High Strength Steels	
D. Pellegrini, J. Lechler, A. Ghiotti, S. Bruschi and M. Merklein	297

Investigation Mechanism of V-Ring Indenter Geometry in Fine-Blanking Process S. Thipprakmas and M. Jin	305
--	-----

IX. Tube Forming

Development of the Hot Gas Bulging Process for Aluminium Alloy Tube Using Resistance Heating T. Maeno, K. Mori and K. Fujimoto	315
Investigations on Three-Roll Bending of Plain Tubular Components M. Merklein, H. Hagenah and M. Cojutti	325
Investigation of Die Corner Filling in Hydroforming of Cylindrical Stepped Tubes Using Finite Element Simulation and Experiment M. Bakhshi-Jooybari, M. Elyasi, A. Gorji, G. Mohammad-Alinejad, S.J. Hosseini-pour and S. Nourouzi	335

X. Incremental Forming

Incremental Sheet Forming Analysed by Tensile Tests W.C. Emmens and T. van den Boogaard	347
Comparison of some Final Part Geometrical Characteristics of Cylindrical Cups Manufactured by Deep-Drawing and Two-Point Incremental Sheet Forming B. Taleb Araghi, M. Bambach and G. Hirt	355
Prediction of Path Deviation in Robot Based Incremental Sheet Metal Forming by Means of an Integrated Finite Element – Multi Body System Model H. Meier, R. Laurischkat, C. Bertsch and S. Reese	365
On a Simplified Model for the Tool and the Sheet Contact Conditions for the SPIF Process Simulation C. Robert, L.B. Ayed, A. Delamézière, P. dal Santo and J.L. Batoz	373
Application of Neural Network Technique to Predict the Formability in Incremental Forming Process G. Ambrogio and L. Filice	381
Experimental Tests to Study Feasibility and Formability in Incremental Forming Process A. Aldo, E. Ceretti, A. Fiorentino, L. Mazzoni and C. Giardini	391
Investigation of Deformation Phenomena in SPIF Using an In-Process DIC Technique I. Vasilakos, J. Gu, B. Belkassem, H. Sol, J. Verbert and J.R. Duflou	401

XI. Modelling

A Neural Network Based Approach for the Design of FSW Processes G. Buffa, L. Fratini and F. Micari	413
Modelling the Effect of Pre-Strain and Inter-Stage Annealing on the Stretch Forming of a 2024 Aluminium Alloy R.J. McMurray, M. O'Donnell, A.G. Leacock and D. Brown	421
An Improved Two-Dimensional Constitutive Law for Shape Memory Alloys W. Wang, S. Yan, G.B. Song and L. Jiao	429
Analysis of the Hydraulic Bulge Test with FEA Concerning the Accuracy of the Determined Flow Curves A. Güner, A. Brosius and A.E. Tekkaya	439
Simulating the UltraSTEEL™ Surface Dimpling Process C.J. Wang, D.J. Mynors and M. English	449

XII. Materials and Testing

The Effects of Thickness on the Formability of 2000 and 7000 Series High Strength Aluminum Alloys A.A. Zadpoor, J. Sinke and R. Benedictus	459
--	-----

A Contribution to the Optimisation of a Simple Shear Test M. Merklein and M. Biasutti	467
The Formability of Aluminum Foam Sandwiches: Experimental and FEM Analysis G. D'Urso, G. Pellegrini and G. Maccarini	473
The Effect of Specimen Dimensions on Obtained Tensile Properties of Sheet Metals L. Han, N.C. Reynolds, I. Dargue and G. Williams	481
Potential of Melted Polymer as Pressure Medium in Sheet Metal Forming M.M. Hussain, B. Rauscher, M. Trompeter and A.E. Tekkaya	493
Double Indentation of Laser Welded Butt Joints of Stainless Steel Sheets L. Santo, E.A. Squeo and F. Trovalusci	503
Assessment of the Modified Maximum Force Criterion for Aluminum Metallic Sheets D. Banabic and S. Soare	511
Material Behaviour Modelling for Finite Element Vehicle Crash Simulation K. Rabbani, M. Daniels, N. Walker and B. Shirvani	521
Microstructure, Mechanical and Corrosion Behaviour of Dissimilar Weldments between AISI 304 Stainless Steels and AISI 1020 Carbon Steels Produced by Gas Tungsten Arc Welding Using Different Consumables W. Chuaiphan, S. Chandra-Ambhorn, B. Sornil and W. Bleck	533
A New Description of Yield Loci Based on Polycrystal Plasticity for High Strength Steels Y.G. An, H. Vegter and L. Carless	543
Tool Geometry in Friction Stir Welding of Magnesium Alloy Sheets C. Bruni, G. Buffa, L. d'Apolito, A. Forcellese and L. Fratini	555

XIII. Drawing

Flexible Draw Bending of Profiles J. Rosenberger, B.A. Behrens, S. Hübner, D. Süße and V. Ulbricht	565
Prevention of Partial Draw-In During High Speed Deep Drawing H. Wielage and F. Vollertsen	571
Affect of Part Geometry on Wall Features in Rectangular Deep-Drawing Processes Using Finite Element Method S. Thipprakmas	579
Process Parameter Effects on the LDR in Warm Deep Drawing of Magnesium Alloys G. Ambrogio, L. Filice, A. Forcellese, G.L. Manco and M. Simoncini	587
Enhancing Deep Drawing Processes by Using a Thermomechanical Tool Design K. Voges-Schwieger, S. Hübner and B.A. Behrens	595
Deep Drawing Process Design: A Multi Objective Optimization Approach R. Di Lorenzo, G. Ingarao, L. Marretta and F. Micari	601

XIV. Bending

Bendability of Ultra-High-Strength Steel A. Väisänen, K. Mäntyjärvi and J.A. Karjalainen	611
Springback Compensation by Superposition of Stress in Air Bending A. Weinrich, N. Ben Khalifa, S. Chatti, U. Dirksen and A.E. Tekkaya	621
Numerical Prediction of Residual Stresses in Laser Bending of Stainless Steel Sheet Metals C. Gheorghies, D. Nicoara, V. Paunoiu, F. Quadrini, L. Santo and E.A. Squeo	629

XV. Roll Forming

Prediction of Roll Profile Wear in the Cold Roll Forming Process A.S. Galakhar, W.J.T. Daniel and P.A. Meehan	643
UHS Steel Formability in Flexible Roll Forming K. Mäntyjärvi, M. Merklein and J.A. Karjalainen	661

Effect of Coiling Temperature on the Formation and Pickling Behaviour of Tertiary Scale on Hot-Rolled Carbon Steel Strip

S. Chandra-Ambhorn, S. Ieamsupapong, V. Thanateponake and W. Suksamai

669

XVI. Single Point Incremental Forming

Obtainable Accuracies and Compensation Strategies for Robot Supported SPIF

J. Verbert, R. Aereens, H. Vanhove, E. Aertbeliën and J.R. Duflou

679