

IWOTE'08

Final Program

International Workshop
on Thermal Forming and
Welding Distortion

April 22-23, 2008
Bremen, Germany



Introduction

Nowadays, welding is a widespread and highly developed joining method. More than 120 automatic and manually operated processes are applicable. As an unwanted side effect, heating and melting induce thermal strains and alter certain material properties. This leads to distortions and high residual stresses which should obviously be kept to a minimum. Therefore, various strategies are being developed in order to minimize distortions; materials are investigated and mechanical as well as thermal boundary conditions are researched. In contrast to welding, the aim of thermal forming is to deliberately use thermal strains to generate predicted shapes. In thermal forming well-defined heat sources offer a reproducible heat input into a highly localized area. The different forming mechanisms are specified and further investigated. Furthermore, thermal forming can overcome limits of the accessibility and avoid disadvantages of mechanical forming like the spring-back effect.

The intention of the 2nd IWOTE is to combine knowledge and experience in the fields of welding and thermal forming. This may be knowledge on temperature and microstructure dependent material properties, heating strategies and strategies to control (de-) formations as well as experience in experimental methods or modelling.

Objectives

The workshop is intended to promote the exchange of experience at international level and foster the dialogue between science and industry, related to the shape changing phenomena in thermal forming and welding.

Tuesday, April 22, 2008

08:00 Registration

08:30 F. Vollertsen

BIAS - Bremer Institut für angewandte Strahltechnik
GmbH, Bremen, Germany

Welcome and Introduction

08:40 H. Wohlfahrt

Institut für Füge- und Schweißtechnik,
Braunschweig, Germany

Influences on Distortions due to Welding. Consequences for Thermal Forming

Measurement Technologies

09:00

C. von Kopylow, J. Sakkiettibutra, F. Vollertsen

BIAS - Bremer Institut für angewandte Strahltechnik
GmbH, Bremen, Germany

Distortion Measurements For Thermal Processes

09:20

A.M. Paradowska¹, J.W.H. Price², T.R. Finlayson³

¹ Rutherford Appleton Laboratory, Didcot, United Kingdom

² Department of Mechanical Engineering, Monash
University, Clayton, Australia

³ School of Physics, The University of Melbourne,
Melbourne, Australia

Efficient Use of Available Techniques to Measure Residual Stresses in Welded Components

Stress and Strain Determining Factors

09:40

C. Schwenk, M. Rethmeier

Federal Institute for Materials Research and Testing
BAM, Berlin, Germany

Influence of Material Properties on Numerically Calculated Welding Distortions

- 10:00 J. Sakkiettibutra, F. Vollertsen
BIAS - Bremer Institut für angewandte Strahltechnik
GmbH, Bremen, Germany
**Effects of Varying Heating Duration on Thermal
Upsetting**
- 10:20 Coffee Break
- 10:40 Z. Mucha
Center for Laser Technology of Metals, Kielce University
of Technology & Polish Academy of Sciences,
Kielce, Poland
Efficiency of Materials Laser Forming
- 11:00 V.D. Shelyagin, V.Y. Khaskin, A.V. Bernatsky, O.V. Siora
E.O. Paton Electric Welding Institute, NASU,
Kyiv, Ukraine
Residual Strains in Welding of Aluminium Alloys
- 11:20 L. Qi, Y. Namba
Dept. of Mechanical Engineering, Chubu University,
Kasugai, Japan
Precision Laser Adjustment Using CW Diode Laser
- 11:40 T. Schenk^{1,3}, I.M. Richardson^{1,2}, G. Eßer³, M. Kraskac,
S. Ohnimus³
¹ Netherlands Institute for Materials Research,
Delft, The Netherlands
² Technical University of Delft, Faculty of 3ME,
Delft, The Netherlands
³ INPRO GmbH, Berlin, Germany
**Welding Distortion of DP600 Overlap Joints and
Influence of Clamping and Phase Transformation**

12:00 M.F. Zaeh, A. Schober, L. Papadakis
Institute for Machine Tools and Industrial Management
(iwb), Munich, Germany

**Sensitivity Analysis of Welding Heat Effects by
Varying Modelling Parameters**

12:20 Lunch

Thermal Assisted Forming

14:20 B. Callebaut¹, L. Rabe², J.R. Dufloy¹

¹ University of Leuven, Dept. Mechanical Engineering,
Heverlee, Belgium

² Royal Military Academy, Dept of Civil and Materials
Engineering, Brussels, Belgium

**Influence of Laser Assisted Single Point Incremental
Forming on Residual Material Properties**

14:40 K. Lamprecht, G. Deinzer

AUDI AG, Ingolstadt, Germany

Hot Sheet Metal Forming in Automotive Production

Welding and Forming Strategies

15:00 M. San Sebastian^{1,2}, E. Maidagan², P. Alvarez^{1,2},
A. Echeverria^{1,2}

¹ LORTEK, Technological Centre, Ordizia, Spain

² Cooperative Research Centre marGUNE,
Elgoibar, Spain

**Hardfacing Optimization through Numerical
Prediction of Welding Overlay Distortions and
Residual Stresses**

15:20 Coffee Break

- 15:40 E.M. van der Aa¹, M.J.M. Hermans², I.M. Richardson³
¹ Corus Research Development and Technology, IJmuiden, The Netherlands
² Delft University of Technology, Department 3ME, Faculty MSE, Delft, The Netherlands
³ Netherlands Institute for Metals Research, Delft, The Netherlands
Simplified Models for the Investigation of Longitudinal Welding Stress And Strain Development
- 16:00 T. Loose, R. Ilieva
Ingenierbüro Tobias Loose, Karlsruhe, Germany
Distortion of Circumferential Welds of Cylindrical Shells with Respect to Tacking and Welding Sequence
- 16:20 H. Hagenah, R. Plettke, M. Geiger
Chair of Manufacturing Technology, Friedrich-Alexander University of Erlangen-Nuremberg, Erlangen, Germany
Algorithms for Planning and Control of Laser Forming Applications
- 16:40 S. Knupfer, S. Rouquette, A.J. Moore
School of Engineering and Physical Sciences, Heriot-Watt University, Edinburgh, United Kingdom
Straightening of Distorted Welded Plates by Iterative Laser Forming
- 17:00 H. Shen¹, Z. Yao²
¹ BIAS – Bremer Institut für angewandte Strahltechnik, Bremen, Germany
² School of Mechanical Engineering, Shanghai Jiao Tong University, Shanghai, P.R. China
Analysis of Varying Velocity Scanning Schemes on Bending Angle in Laser Forming
- 17:20 Coffee Break

- 17:40 S. Williams¹, S. Morgan², A. Wescott², M. Poad³, S. Wen⁴
¹Cranfield University, Welding Engineering Research Centre, Cranfield, United Kingdom
²BAE Systems, Advanced Technology Centre, Filton, United Kingdom
³Airbus UK, Filton, United Kingdom
⁴Corus, Moorgate, Rotherham, United Kingdom
Stress Engineering – Control of Residual Stresses and Distortion in Welding
- 18:00 L.J. Yang^{1,2}, Y. Wang¹, M.L. Wang¹, Y.B. Chen²
¹ Department of Mechanical Manufacturing and Automation, Harbin Institute of Technology, Harbin, P.R. China
² State Key Laboratory of Advanced Welding Production Technology, Harbin Institute of Technology, Harbin, P.R. China
Research on 3D Laser Forming of Square Metal Sheet to Spherical Dome
- 19:30 Dinner

Wednesday, April 23, 2008

Welding and Forming in Ship Building

- 09:00 W.J. Seong, J.S. Ahn, S.-J. Na
Division of Mechanical Engineering, KAIST, Daejeon, Republic of Korea
A Study on Geometrical Approach for Solving Inverse Problem of 2D Flame Forming of Ship Hull Plates
- 09:20 T. Nagy, S. Williams, P. Colegrove, C. Ikeagu, I. Fafiolu
Cranfield University, Welding Engineering Research Center, Cranfield, United Kingdom
Distortion Mitigation in Welded Ship Panels

- 09:40 J.E. Jones, G.E. Turner, V.L. Rhoades, P. Sarnow,
A. Cuneo, J. Gaffney, R. Arner
Native American Technologies Company, Golden, USA
**Weld Distortion Mitigation in Shipbuilding by
Automated Thermal Forming Using Flexible
Automation Robotics**
- 10:00 P. Seyffarth¹, O. Machnenko¹, M. Heinemann²,
J. de Payrebrune², M. Schilf³, M. Koerd³
¹ IMG Ingenieurtechnik und Maschinenbau GmbH,
Rostock, Germany
² Flensburger Schiffbau Gesellschaft mbH & Co. KG,
Flensburg, Germany
³ BIAS- Bremer Institut für angewandte Strahltechnik
GmbH, Bremen, Germany
**Automatically Thermal Straightening in Shipbuilding
and Related Branches**
- 10:20 Coffee Break

Modelling of Large Structures

- 10:50 Z. Akbay¹, T. Pretorius¹, J. Montalvo-Urquizo², F. Vollertsen¹
¹ BIAS – Bremer Institut für angewandte Strahltechnik
GmbH, Bremen, Germany
² ZeTeM – Zentrum für Technomathematik,
Bremen, Germany
**Fast FEM-Model and Keyhole-heat Source model
for Self-Optimized Simulation of Laser Welding
Processes**
- 11:10 M. Grden, F. Vollertsen
BIAS – Bremer Institut für angewandte Strahltechnik
GmbH, Bremen, Germany
**Fast Simulation Method of Thermal Bending along
Curved Irradiation Paths**

- 11:30 I. Prithwani, A. Otto
Chair of Manufacturing Technologies, Erlangen, Germany
Simulation of Laser Beam Forming of Large Aluminium Plates
- 11:50 A. Prihodovsky, V. Ploshikin, A. Ilin, T. Frank, C. Heimerdinger
Validation of the Numerical Method for the Fast Prediction of Welding Distortions of Large Aircraft Structures
- 12:10 Lunch

Process Chains and Structure Interactions

- 14:00 K. Schimanski¹, A. von Hehl¹, H.-W. Zoch¹, N. Jordan²
¹ Stiftung Institut für Werkstofftechnik, Bremen, Germany
² Airbus Deutschland GmbH, Bremen, Germany
Distortion Potentials in Process Chains including Laser Beam Welding
- 14:20 E. Abed, S.P. Edwardson, K.R. Edwards, C. Carey, G. Dearden, K.G. Watkins
Laser Engineering Group, Dept. of Engineering, The University of Liverpool, United Kingdom
Effect of Post Forming Heat Treatments on Laser Formed Components
- 14:40 V. Makhnenko, A. Milenin
E.O. Paton Electric Welding Institute, NASU, Kyiv, Ukraine
Analysis of the Thermodeformed State of Laser Brazed-Welded Ti-Al Beam Structures by Means of Mathematical Modelling
- 15:00 M. Brand¹, A. Junk², M. Luke¹
¹ Fraunhofer-Institut für Werkstoffmechanik, Freiburg, Germany
² CADFEM GmbH, Hannover, Germany
Prediction of Welding Distortions and Residual Stresses Considering Preheating, Pre-stress and Contact Conditions in Axial Circular Laser-beam Welds

Micro Adjustment

- 15:20 M. Zimmermann, M. Rank, M. Schmidt
Bayerisches Laserzentrum, Erlangen, Germany
Simulation and Optimization of an Actuator for Laser Micro Alignment of an Optical Fiber to a Microlens
- 15:40 J. Widłaszewski
Institute of Fundamental Technological Research of the Polish Academy of Sciences, Warsaw, Poland
Analysis of Deformations Induced by a Laser Beam Pulse
- 16:00 Coffee Break

Fundamentals and other Processes

- 16:30 M. Maalekian^{1,2}, E. Kozeschnik^{1,2}, H. Cerjak¹
¹ Institute for Materials Science and Welding
² Christian Doppler Laboratory for Early Stages of Precipitation, Graz University of Technology, Graz, Austria
Heat Generation in Friction Welding
- 16:50 Y. Okamoto¹, Y. Uno¹, Z. Mohid¹, Y. Namba²
¹ Graduate School of Natural Science and Technology, Okayama University, Okayama, Japan
² Department of Mechanical Engineering, Chubu University, Kasugai, Japan
Influence of Irradiation Method on Laser Forming Characteristics of Plastics
- 17:10 F. Brückner¹, D. Lepski¹, E. Beyer^{1,2}
¹ Fraunhofer Institute for Material and Beam Technology, Dresden, Germany
² Institute of Surface and Manufacturing Technology, Dresden University of Technology, Dresden, Germany
Reduction of Thermally Induced Distortion in Laser Cladding

- 17:30 K.R. Edwards, S.P. Edwardson, C. Carey, C.H. Williams,
G. Dearden, K.G. Watkins
Laser Group, Dept. of Engineering,
The University of Liverpool, United Kingdom
**Laser Peen Forming for Non-Thermal Forming of
Sensitive Components**
- 17:50 V.V. Avilov, R. Moldovan, P. Berger, T. Graf
IFSW Institut für Strahlwerkzeuge,
University of Stuttgart, Stuttgart, Germany
**Electromagnetic Weld Pool Control Systems for
Laser Beam Welding of Thick Metal Plates**
- 18:10 Conclusions

Information

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