There were 144 attendees registered, and approximately 107 papers were presented, including 67 oral presentations and 40 posters.

It was apparent from the papers presented that the research and development activity in the area of superplasticity and superplastic forming is of substantial interest world-wide, and a number of papers reported results that are considered to be significant and which may point the direction for future research that should prove fruitful.
FINAL REPORT

INTERNATIONAL CONFERENCE ON SUPERPLASTICITY
AND SUPERPLASTIC FORMING

August 1-4, 1988

Blaine, Washington

Report To

U. S. Army Research Office
(Contract No. DAAL0388G0032)

C. H. Hamilton
Washington State University
Pullman, WA

N. E. Paton
Rockwell International
Canoga Park, CA

August 9, 1988
The International Conference on Superplasticity and Superplastic Forming was held at the Inn at Semiahmoo in Blaine, WA on 1-4 August, 1988. There were 144 attendees registered, and approximately 107 papers were presented, including 67 oral presentations and 40 posters. Attendees represented 17 different countries. Enclosed are copies of the program and list of attendees. The proceedings will be published by The Metallurgical Society, and should be available about November, 1988. Copies will be forwarded to AFWAL when they are available.

It was apparent from the papers presented that the research and development activity in the area of superplasticity and superplastic forming is of substantial interest world-wide, and a number of papers reported results that are considered to be significant and which may point the direction for future research that should prove fruitful. Noteworthy among these are 1.) the activities addressing high rate superplasticity, through both alloy development and process concept studies, 2.) computer modeling of the SPF process, including finite element methods coupled with 3-D color graphics displays of thinning characteristics, 3.) superplasticity in ceramic and intermetallic compound materials, 4.) solid-state joining (diffusion bonding) of aluminum alloys, 5.) demonstration that there are microstructural concepts other than that of fully recrystallized structure which can lead to superplasticity, especially at high rates, and 6.) significant extension in the state of understanding of the interrelationship between microstructural dynamics and superplastic properties, including fundamentals of superplasticity and cavitation development. 

It is now clear that the concepts of superplastic forming as being a slow forming process (ie., requiring times of the order of 15 minutes to several hours) are no longer valid. Superplasticity at strain rates in the range of .1 to 2.5 s⁻¹ have been reported. For example, the work of Beiler et al (paper 60), Matsuki et al (paper 84), and Ghandi et al (paper 14) clearly show that very high rate superplasticity is possible, especially if dynamic recrystallization processes are involved during the superplastic deformation. In addition, concepts of variable strain rate deformation processing, rather than constant strain rate, also hold promise for increasing the SPF process rate as
indicated by Ohsawa (paper 61), Ash et al (paper 42), and Ghosh (paper 68).

Perhaps the most exciting new developments in superplasticity are those in the area of "difficult-to-form" materials, such as the ceramics, intermetallic compounds, composites and mechanically alloyed metals. For example, it was reported that a ceramic material (Y-TZP ZrO2) was just recently stretched in tension to an elongation of over 900%, and exceptional achievement (paper 9). Superplastic forming appears to offer an effective way of shaping many other materials, such as Ti aluminides and other intermetallic compounds, as well as certain metal matrix composites.

The applications of SPF parts continues to increase both in aerospace and non-aerospace areas. Titanium continues to be the primary material processed for aerospace, although the development in Al SPF is accelerating and utilization is increasing as new commercial alloys become available. A number of Ti, Al, Fe, and Ni alloy parts were shown by the European, Chinese, and Russian authors (eg. papers 1,22, 26, 27, 52, 76, 77, 78, 97, 106, and 107).

It is noteworthy that in several countries, there are nationally coordinated research groups on superplasticity. Such groups include the Japan Research Group on Superplasticity, a similar group in the Peoples Republic of China, a Center for the Study of Superplasticity Problems in the USSR with 500 researchers, and group recently established in the United Kingdom for exchange of ideas and information on superplasticity.

The Organizers decided to establish a "Best Paper" award for the manuscripts submitted for the Conference, and present the author(s) with a $500 honorarium. The award was based on the written manuscripts only. The award was presented to T. R. Bieler, T. G. Nieh, J. Wadsworth, and A. K. Mukherjee for their paper "High Rate Superplastic Behavior of Mechanically Alloyed Al IN90211" (paper 60) based on the significance, technical quality and clarity of their paper.

The Organizing Committee met during the Conference to discuss the interest and research progress in superplasticity, and to explore the need for future conferences. It was the conclusion of the Committee that interest in superplasticity and related progress were sufficient to justify a subsequent international conference, and it was agreed
that Japan would host the next conference, and that it would be scheduled for 1991. The specific site and date will be identified at a later date by the Japanese members of the Organizing Committee.

The following Appendices include the list of attendees and a copy of the program for the Conference.
APPENDIX A

PROGRAM

International Conference on Superplasticity and Superplastic Forming
INTERNATIONAL CONFERENCE ON SUPERPLASTICITY AND SUPERPLASTIC FORMING

TECHNICAL PROGRAM

SUNDAY, JULY 31
15:30 - 19:00 Registration in Ballroom Lobby
17:00 - 19:00 Social Mixer featuring a San Francisco pasta bar, beer and wine in Blakely Room

MONDAY, AUGUST 1
7:00 - Registration and coffee/pastries in Ballroom Hallway
8:00 - Welcoming Comments - C. Howard Hamilton, Conference Co-Chair

All meetings will be held in the Cypress and Orca Rooms.

MONDAY, AUGUST 1

SESSION I: FUNDAMENTALS
Chair: C. Howard Hamilton, Washington State University, U.S.A.

Keynote Speaker
8:15 Paper 1 O. A. KAIBYSHEV, USSR Academy of Sciences
Current Problems of the Material Science of Superplasticity

8:50 Paper 2 SHIGENORI HORI and NORIO FURUSHIRO, Osaka University
Metallographical Research on Superplasticity

9:10 Paper 3 M. J. MAYO, Sandia National Laboratories and W. D. NIX, Stanford University
Direct Observations and Micromechanical Testing of Superplastic Alloys

9:30 Paper 4 G. S. MURTY, Indian Institute of Technology and M. J. KOCZAK, Drexel University
Investigation of Region I in Rapidly Solidified Powder Al Alloys

9:50 Break

10:10 Paper 5 R. I. TODD and P. M. HAZZLEDINE, Oxford University
The Mechanism of Superplasticity and its Implications

10:30 Paper 6 SHANYOU ZHOU, LIQIN WANG and CHIN LIU, Shanghai Jiao Tong University
The Role of Grain Boundary Dislocations During Superplastic Deformation of an Al Alloy

10:50 Paper 7 R. Z. VALIEV, USSR Academy of Sciences
The Physical Model of Superplasticity Based on the Notion of Non-equilibrium Grain Boundaries

11:10 Paper 8 G. TORRES VILLASEÑOR, Universidad Nacional Autómoma de México and J. NEGRETE, Universidad Autónoma de San Luis Potosi
Superplastic Behavior of Zn-20Al-2Cu at Room Temperature and Deformation Mechanisms
11:30 Paper 9 J. WADSWORTH, T. G. NIEH, Lockheed Missiles & Space Company, Inc., and OLEG SHERBY, Stanford University
Some Recent Advances in the Development of Fine-grained Superplastic Al Alloys, Ceramics, and Laminated Composites

12:15 Lunch in Blakely Room

MONDAY, AUGUST 1

SESSION II: MICROSTRUCTURAL DYNAMICS
Chair: Peter Partridge, Royal Aircraft Establishment, England

Keynote Speaker
13:30 Paper 10 D. S. WILKINSON, McMaster University
Microstructural Instability During Superplastic Flow

Keynote Speaker
14:25 Paper 11 R. GRIMES, Alcan International Limited
Microstructural Evolution in Superplastic Al Alloys

15:00 Paper 12 N. G. ZARIPOV and R. O. KAIBYSHEV, USSR Academy of Sciences
Dynamic Recrystallization and Superplasticity of a Mg Alloy

15:20 Break

15:40 Paper 13 JIN QUANLIN, BAI BINGZHE, LAI WEIHUA, GUO XUSHENG and ZHANG HONG, Beijing Research Institute of Mechanical and Electrical Technology of SIME
Grain Refinement by Torsion and Superplasticity in High-strength Al Alloy

16:00 Paper 14 CHIMATA GANDHI and AMIT K. GHOSH, Rockwell International Science Center
Superplasticity in High-strength Al Alloys

16:20 Paper 15 G. A. SALISHCHEV and R. Ya. LUTFULLIN, USSR Academy of Sciences
The Transformation of Ti Alloy Laminar Microstructure into a Microduplex One

16:40 Paper 16 P. LUKÁČ, Charles University
The Role of Matrix Dislocations in the Superplastic Deformation

17:00 Paper 17 EIICHI SATO, KAZUHIKO KURIBAYASHI AND RYO HORIUCHI, The Institute of Space and Astronautical Science
Superplastic Deformation Induced Grain Growth in Microduplex and Second Phase Dispersed Alloys

Dinner on your own.

SESSION III: POSTER SESSION
20:30 - 22:30 in the Ballroom Lobby

Paper 18 D. V. DUNFORD and P. G. PARTRIDGE, Royal Aircraft Establishment
Deformation of Ti-6Al-4V Bar and Extrusion Under Superplastic Forming Conditions

Paper 19 N. DYULGEROV, A. ISTATKOV, N. MITEV, and I. SPIROV, Bulgarian Academy of Sciences
Superplastic Low Manganese Zinc-Manganese Alloys
<table>
<thead>
<tr>
<th>Paper</th>
<th>Authors</th>
<th>Title</th>
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<tbody>
<tr>
<td>21</td>
<td>K. OSADA, Nippon Yakin Kogyo Co., Ltd.</td>
<td>Properties of a Microduplex Stainless Steel Superplastically Deformed</td>
</tr>
<tr>
<td>23</td>
<td>R. A. RICKS, J. BALL, Alcan International Limited; H. STOKLOSSA, MBB Central Laboratories, P.-J. WINKLER, MBB Central Laboratories, and R. GRIMES, British Alcan Aluminium</td>
<td>Bonding of Al-Li Base Alloys Using Roll Clad Zn Interlayers</td>
</tr>
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<td>24</td>
<td>WANG YANWEN, FENG ZEZHOU and SUN SHANGCHEN, Beijing Research Institute of Mechanical and Electrical Technology of SCMI</td>
<td>Transformation Superplasticity Solid-state Bonding in Steels</td>
</tr>
<tr>
<td>25</td>
<td>P. G. PARTRIDGE and D. V. DUNFORD, Royal Aircraft Establishment</td>
<td>Effect of Superplastic Deformation on the Surface Roughness of Sheet</td>
</tr>
<tr>
<td>26</td>
<td>LI YOU-QIN and ZHANG SHI-LING, Beijing Aeronautical Manufacturing Technology Research Institute</td>
<td>Study on SPF and SPF/DB of the Bulkhead Structure with Nonsymmetric Shape</td>
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<tr>
<td>27</td>
<td>HAI JINTAO, LU XIN, YANG LUYI, ZHANG GUOPIN and BAI BINZHE, Beijing Research Institute of Mechanical and Electrical Technology of SCMI</td>
<td>Superplastic Forming of Ti-Alloy Turbine Blade</td>
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<tr>
<td>28</td>
<td>WANG CHENG and LUO YING-SHE, Xiangtan University</td>
<td>New Advance of Superplastic Forming Process for Commercial Structural Alloys</td>
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<tr>
<td>29</td>
<td>SONG YU-QUAN, Jilin University of Technology; ZHANG ZHEN-JUN, Chinese Academy of Agricultural Mechanization Sciences and LIAN SHU-JUN, Jilin University of Technology</td>
<td>Mechanical Analysis About Deformation Laws of Superplastic Extrusion Through Cone-shaped Dies</td>
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<tr>
<td>30</td>
<td>MURRAY W. MAHONEY and ROY CROOKS, Rockwell International Science Center</td>
<td>Mechanisms of Superplastic Flow in Inconel 718</td>
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<tr>
<td>31</td>
<td>HUANG LIPING, Shanghai Iron &amp; Steel Research Institute</td>
<td>The Study of Reducing Superplastic Temperature in Ti Alloys</td>
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<tr>
<td>32</td>
<td>SU SHENGGUI, SHEN HUANXIANG and SONG SHENG-ZHE, Northeast Institute of Heavy Machinery</td>
<td>An Approach to the Superplasticity of Al Brass (HAL 66-6-3-2)</td>
</tr>
<tr>
<td>33</td>
<td>J. J. BLANDIN, Institut National Polytechnique de Grenoble; J. Y. LAÇROIX, Centre de Recherches et Développement Cégédur-Pechiney and M. SUERY, Institut National Polytechnique de Grenoble</td>
<td>Superplasticity and Cavitation of the 2091 Al-Cu-Li-Mg Alloy</td>
</tr>
</tbody>
</table>
Paper 34  WANG CHUNRONG, SONG HAILONG, QU LI and CHAO SHUZHI, Institute of Metal Research, Academia Sinica
Superplastic Formability to Distinguish the Metallic Thin Wall Components by Criteria and Criterion-model

Forming Characteristics of Structural Al Alloys (Combined with "Forming Characteristics and Mechanical Properties of Superplastic Al-Li Based Alloys 8090 and 8091")

Paper 36  ATUL H. CHOKSHI and AMIYA K. MUKHERJEE, University of California-Davis
The Influence of Hydrostatic Pressure on Cavitation and Failure in Superplastic Al-based Alloys

Paper 37  A. VARLOTEAUX, J. J. BLANDIN and M. SUÉRY, Institut National Polytechnique de Grenoble
Influence of Uni- and Bi-axial Straining on Cavitation in a Superplastic Al Alloy

Paper 38  K. HIGASHI, University of Osaka Prefecture and N. RIDLEY, University of Manchester/UMIST
Thermomechanical Processing and Superplasticity in a Commercial Cu-base Alloy

Paper 39  PARVIN SHARIAT, Northrup University and TERENCE G. LANGDON, University of Southern California
The Influence of Specimen Profile and Notch Geometry on Superplasticity in Zn-22% Al

Paper 40  CHEN HECHUN and YANG ZHENHENG, Northwestern Polytechnical University
The Relationship Between Strain-rate Sensitivity Index and Strain in Superplasticity

Paper 41  C. HAMMOND, A. NICHELLS, University of Leeds, and N. E. PATON, Rockwell International
Photoemission Electron Microscopy of Superplastic Deformation Mechanisms in Al Alloy 7475 and Ti Alloy Ti-6%Al-4%V

Paper 42  B. ASH and C. H. HAMILTON, Washington State University
Factors Affecting Superplastic Stability in an Al-Li-Cu-Zr Alloy

Paper 43  BINYAN REN and C. H. HAMILTON, Washington State University
The Microstructural Characteristics of an Al-Li-Cu-Mg-Zr Alloy During the Initial Stage of Superplastic Deformation

Paper 44  JIANZHONG CUI, QINLING WU and LONGXIANG MA, Northeast University of Technology
Effect of Grain Size on Region Transition Behavior in Superplastic Deformation

The Effects of Superplastic Deformation on the Microstructure and Hardening Characteristics of High Strength 8091 Al-Li Alloy

Paper 46  L. R. ZHAO, S. Q. ZHANG and M. G. YAN, Institute of Aeronautical Materials
Details of the Alpha Grain Boundaries in Annealed and Superplastically Deformed Ti-6Al-4V Alloy

Paper 47  L. R. ZHAO, S. Q. ZHANG and M. G. YAN, Institute of Aeronautical Materials
Improvement in the Superplasticity of Ti-6Al-4V Alloy by Hydrogenation
Paper 48  Z. R. WANG, XU YANWU, GUO DIANJIAN, Harbin Institute of Technology, YIN CHANGKUI, Beijing Agricultural Engineering University
An Experimental Study of Yield Criteria Using Superplastic Thin-walled Tubes Subjected Tension-torsional Combined Loads

A Study on Superplasticity of Commercial 2024Al Alloy

Paper 50  PAN YAOQIN, LIU WEIMIN and SONG ZUOZHOU, Beijing Institute of Aeronautics and Astronautics
Superplasticity in Ti-10V-2Fe-3Al Alloy

Paper 51  XI JUKUI, XU CHUNHUA, and YANG YUNLIN, Luoyang Institute of Technology
Superplastic Boriding of Steel

Paper 52  J. WITTENAUER, P. SCHEPP and and B. WALTER, Sulzer Brothers AG
Application of Superplastic UHC Steel for Isothermal Forging of Machine Component

Paper 53  ZHAO MIN and CHEN PUQUAN, Harbin Institute of Technology
A Complex Deformation Mechanism for Superplastic Deformation of Mg Alloys

Paper 54  JIN TAO, ZHAO MIN and CHEN PUQUAN, Harbin Institute of Technology
A Deformation Mechanism for Superplastic Deformation of Age Strengthening Cu Alloy

Paper 55  HAN SHUZHI, Northeast University of Technology
Study on Improving the Performance of Zn-22%Al Eutectoid Superplastic Alloys

Paper 56  J. F. YANG, PENG XU AND H. WANG, Harbin Institute of Technology
Effects of Second Phase Particles on the Cavitation of Superplasticity

Paper 57  TAKAYUKI NAGANO, HIDEZUMI KATO, Suzuki Motor Co. Ltd. and FUMIHIRO WAKAI, Government Industrial Research Institute
Diffusion Bonding of ZrO2/Al2O3 Composite

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TUESDAY, AUGUST 2

SESSION IV: RHEOLOGY and CAVITATION
Chair: Oleg Sherby, Stanford University, U.S.A.

Keynote Speaker  
8:00  Paper 58  B. BAUDELET and M. SUERY, Institut National Polytechnique de Grenoble
Plastic Stability and Strain to Fracture During Superplastic Deformation

Keynote Speaker  
8:35  Paper 59  ATUL H. CHOKSHI and AMIYA MUKHERJEE, University of California-Davis
The Role of Cavitation in the Failure of Superplastic Alloys

9:10  Paper 60  T. R. BIELEER, University of California-Davis, T. G. NIEH, J. WADSWORTH, Lockheed Missiles and Space Co., Inc. and A. K. MUKHERJEE, University of California-Davis
High Rate Superplastic Behavior of Mechanically Alloyed Al IN90211
9:30 Paper 61  H. OHSAWA, Hosei University  
Effect of Accelerated/Decelerated Strain Rate on Sheet Formability of α<sub>s</sub>-ε<sub>n</sub> Materials

9:50  Break

10:10 Paper 62  YAN MA and TERENCE G. LANGDON, University of Southern California  
An Investigation of the Characteristics of Cavitation in Superplastic Materials

10:30 Paper 63  O. M. SMIRNOV, Moscow Steel and Alloys Institute  
Rheological Criteria for Rational Use of Superplasticity in Metal Working by Pressure

10:50 Paper 64  TAKUJI OKABE, Kure National College of Technology, TOMEI  
HATAYAMA, Hiroshima University and HIDEO TAKEI, Hiroshima Institute of Technology  
Effect of Strain Rate Dependence of m on Ductility in Superplastic Materials

11:10 Paper 65  J. J. BLANDIN and M. SUERY, Institut National Polytechnique de Grenoble  
Evolution of Cavitation During Superplastic Deformation

11:30 Paper 66  NORIO FURUSHIRO, Osaka University and TERENCE G. LANGDON, University of Southern California  
An Experimental Investigation of Hole Growth and Interlinkage in the Superplastic Zn-22% Al Eutectoid Alloy

11:50 Paper 67  ZHAO YOU-CHANG and LI XIU-QING, Jilin University  
Cavitation Behavior and Dislocation Structure of Commercial Mn-Brass During Superplastic Deformation

12:15 Lunch in Blakely Room

TUESDAY, AUGUST 2

SESSION V: FUNDAMENTALS OF FORMING  
Chair: Peter Winkler, MBB, West Germany

Keynote Speaker  
13:00 Paper 68  A. K. GHOSH, Rockwell International Science Center  
Role of Microstructure and Mechanics on Superplastic Forming

Keynote Speaker  
13:35 Paper 69  MASARU KOBAYASHI, Technological University of Nagaoka  
Novel Processing Methods for Superplastic Alloys

13:55 Paper 70  N. CHANDRA and B. ROY, Florida State University  
Membrane Element Analysis of Axisymmetric and Non-axisymmetric Superplastic Metal Forming Processes

14:15 Paper 71  J. BONET, R. D. WOOD and O. C. ZIENKIEWICZ, University College of Swansea  
Finite Element Modelling of the Superplastic Forming of Thin Sheet

14:35 Break
14:50 Paper 72 J. M. STORY, Aluminum Company of America
Incorporation of Sliding Friction into a Closed-form Model of Plane Strain Superplastic Forming

15:10 Paper 73 Z. X. GUO, University of Manchester/UMIST, J. PILLING, Michigan Technological University and N. RIDLEY, University of Manchester/UMIST
Bulge-forming of Domes: A Comparison of Theoretical Prediction and Experiment

15:30 Paper 74 TAO SHUXUE and MA LONGXIANG, Northeast University of Technology
A Study on Superplastic Alloy Sheet Bulging Under the Microcomputer Control

15:50 Paper 75 J.-L. LEBRUN, M. RESZKA and M. FOULON
Development of a Characterization Test of Materials and of the Parameters for Superplastic Forming of Al Alloys

16:10 Paper 76 CHEN BINGKUN and HAI JINTAO, Beijing Research Institute of Mechanical and Electrical Technology of SCMI
Superplastic Forming of Ti-Alloy Vessel

16:30 Paper 77 S. D. VISWANATHAN, S. VENKATASAMY and K. A. PADMANABHAN
Theoretical and Experimental Studies on the Pressure Thermo-forming of Hemispheres of Alloy Ti-6Al-4V

16:50 Paper 78 B. PLEGE
On the Importance of Microstructure and Forming Parameters in the Manufacture of Ti-6Al-4V SPF/DB Parts

Dinner on your own.

WEDNESDAY, AUGUST 3

SESSION VI: ALLOY DESIGN
Chair: Norman Ridley, University of Manchester/UMIST

Keynote Speaker
8:00 Paper 79 M. YAMAZAKI, National Research Institute for Metals, Japan
Alloy Design of Superplastic Ni-base and Ti-base Alloys

Keynote Speaker
8:35 Paper 80 N. RIDLEY, University of Manchester/UMIST and C. HAMMOND, University of Leeds
Development of Superplastic Behaviour in Various Commercial Materials

Superplastic Optimisation for Diffusion Bonding Applications in Al-Li Alloys

9:30 Paper 82 ZHOU TIECHENG, ZHANG ZHIMIN, ZHANG YANHUI, Taiyuan Institute of Machinery and TANG DEFEN, Beijing Nonferrous Metals and Rare Earth Research Institute
The Development of LFC-X1 Alloy

9:50 Break
**WEDNESDAY, AUGUST 3**

**SESSION VII: SPF METHODS and DIFFUSION BONDING**
Chair: Amit Ghosh, Rockwell International Science Center, U.S.A.

**Keynote Speaker**
13:50 Paper 88 J. PILLING, Michigan Technological University  
*Diffusion Bonding in Superplastic Materials*

14:25 Paper 89 P.-J. WINKLER, MBB GmbH  
*Diffusion Bonding and Combined SPF*

15:00 Paper 90 HUANG YAN and MA LONGXIANG, Northeast University of Technolog  
*A Dynamic Model for Diffusion Bonding of Metals*

15:20 Paper 91 YASUNORI SAOTOME, Gunma University and NOBUHIRO IGUCHI,  
Waseda University  
*Effects of Transformation Superplasticity on the Early Deformation Process of the Solid State Bonding in Pure Iron*

15:40 Break

15:55 Paper 92 J. KENNEDY, Grumman Corporation  
*Diffusion Bonding and Superplastic Forming of 7475 Al Alloy*

16:15 Paper 93 D. S. McDARMAID and P. G. PARTRIDGE, Royal Aircraft Establishment  
*Mechanical Properties of Ti and Al Alloys after Superplastic Deformation*

16:45 Paper 94 ZHANG DIXIANG, Radio Manufacture Factory  
*The Application of Superplastic Forming for Making Plastic Injection Mould*

17:05 Paper 95 MITSUJI HIROHASHI and HIROSHI ASANUMA, Chiba University  
*Combined Extrusion of Superplastic Al-Zn System Alloys*
17:25 Paper 96  YANG YONGCHUN, Beijing Research Institute of Mechanical and Electrical Technology  
Superplastic Behaviour of Die Steel 4Cr-3Mo-3W-2V and Application

WEDNESDAY, AUGUST 3
19:00 No-Host Social on the Terrace (weather permitting)
19:30 - 21:00 Salmon Banquet on the Terrace (weather permitting)

Purchase tickets for spouse and guests by August 1.

THURSDAY, AUGUST 4

SESSION VIII: DESIGN CONCEPTS and FUTURE DIRECTIONS
Chair: Neil E. Paton, Rockwell International, U.S.A.

Keynote Speaker
8:00 Paper 97  HAI JINTAO, DAI JILIN, CHEN SANSHAN, Beijing Research Institute of Mechanical and Electrical Technology; Z. R. WANG AND ZHANG KAIFENG, Harbin Institute of Technology  
Development of Superplastic Technology in China

Keynote Speaker
8:35 Paper 98  R. RAJ, Cornell University  
Mechanisms of Superplastic Deformation in Ceramics

9:10 Paper 99  D. M. WARD, Incoform Limited  
Forming Non-superplastic Materials with Superplastic Membranes

9:30 Paper 100  BRUNO ROLLAND, Avions Marcel Dassault - Breguet Aviation  
SPF-DB Applications for Military Aircraft

9:50 Break

10:10 Paper 101  H. NISHIMURA, S. WAKAYAMA, H. YAMAMOTO, S. YAMAGISHI, Toyko Metropolitan University  
Fabrication of Fiber Reinforced Metal Using Superplastic Metal Powder as Matrix

10:30 Paper 102  FUMIHIRO WAKAI, Government Industrial Research Institute  
Superplasticity of ZrO$_2$ Toughened Ceramics

Extrusion of Tet-ZrO$_2$ at Elevated Temperatures

11:10 Paper 104  T. HERMANSSON, Chalmers University of Technology, P. LAGERLÖF, Case Western Reserve University and G. DUNLOP, Chalmers University of Technology  
Superplastic Deformation of Y-TZP ZrO$_2$

11:30 Paper 105  Y. MUTOH, M. KOBAYASHI, Technological University of Nagaoka, Y. MAE and K. TOYOFUKU, Mitsubishi Metal Corp.  
Post-SPF Fatigue Properties in Ti-6Al-4V Alloy
The Manufacture of SPF Military Aircraft Doors in Al Alloy

12:10  Paper 107  H. E. FRIEDRICH, M. KULLICK and R. FURLAN, MBB GmbH
SPF/DB on the Way to the Production Stage for Ti and Al Applications Within Military and Civil Projects

12:30 - 1:30  Lunch in San Juan Ballroom.

THURSDAY, AUGUST 4
12:45 - 6:50  OPTIONAL TOUR TO BOEING AIRCRAFT ASSEMBLY PLANT in Everett
Bus departs promptly at 12:50.

HAVE A NICE TRIP HOME – THANK YOU FOR COMING!
APPENDIX B

LIST OF ATTENDEES

International Conference on Superplasticity and Superplastic Forming
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<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
<th>Location</th>
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<tbody>
<tr>
<td>Suphal Agrawal</td>
<td>Northrop Aircraft Division</td>
<td>Hawthorne CA</td>
</tr>
<tr>
<td>Rodney Bahr</td>
<td>Boeing Military Airplanes</td>
<td>Wichita KS</td>
</tr>
<tr>
<td>Eric Barta</td>
<td>Boeing Commercial Airplanes</td>
<td>Seattle WA</td>
</tr>
<tr>
<td>Thomas Bieler</td>
<td>Univ of California at Davis</td>
<td>Davis CA</td>
</tr>
<tr>
<td>Jeanine Brantingham</td>
<td>RMI Company</td>
<td>Miles OH</td>
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<tr>
<td>Claude Carry</td>
<td>Polytech Federale de Lausanne</td>
<td>Lausanne Switzerland</td>
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<tr>
<td>Naman Chandra</td>
<td>Florida State University</td>
<td>Tallahassee FL</td>
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<tr>
<td>Atul Chokski</td>
<td>Univ of California at Davis</td>
<td>Davis CA</td>
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<tr>
<td>Peter Comley</td>
<td>Murdock Inc.</td>
<td>Compton CA</td>
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<tr>
<td>Jianzhong Cui</td>
<td>Northeast Univ of Technology</td>
<td>Shenyang China</td>
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<tr>
<td>Richard Delagi</td>
<td>Texas Instruments Incorporated</td>
<td>Attleboro MA</td>
</tr>
<tr>
<td>Gordon Dunlop</td>
<td>Chalmers Univ of Technology</td>
<td>Goteborg Sweden</td>
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<tr>
<td>Beverly Ash</td>
<td>Rockwell International</td>
<td>Canoga Park CA</td>
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<tr>
<td>A.J. Barnes</td>
<td>Superform USA</td>
<td>Riverside CA</td>
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<tr>
<td>Bernard Baudelet</td>
<td>Inst. Nat’l Polytech de Grenoble</td>
<td>Saint Martin D’Heres France</td>
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<tr>
<td>Javier Bonet</td>
<td>University College of Swansea</td>
<td>Swansea WA</td>
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<td>J. Pierre Brunet</td>
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<td>Logan Casteel</td>
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<td>Wonjib Choi</td>
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<tr>
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<td>Sheldon Cytron</td>
<td>U.S. Army ARDEC</td>
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<td>Kishore Desai</td>
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