

Table of Contents

Preface

Towards Innovation in Superplasticity, A Brief Review on the Project T. Sakuma	3
An Examination of Flow Processes in High Strain Rate Superplasticity T.G. Langdon	13
Nature of Superplastic Deformation O.A. Kaibyshev	21
Analysis of Tensile Superplasticity in Nanomaterials R.S. Mishra, S. McFadden and A.K. Mukherjee	31
Enhanced Superplasticity of Ultrafine-Grained Alloys Processed by Severe Plastic Deformation R. Valiev and R.K. Islamgaliev	39
Nano-Grain Formation in a Fully Ferritic SUS 316L Austenitic Stainless Steel Produced by HS-PM Process H. Fujiwara and K. Ameyama	47
Superplasticity of (α+γ) Duplex Stainless Steel with Elongated Secondary Phase T. Furuhashi, K. Hikita and T. Maki	53
Microstructural Evolution for Superplasticity Using Equal-Channel Angular Pressing M. Nemoto, Z. Horita, M. Furukawa and T.G. Langdon	59
Superplastic Behavior of Magnesium Alloy Processed by ECAE M. Mabuchi, M. Nakamura, K. Ameyama, H. Iwasaki and K. Higashi	67
Low Temperature Superplasticity of Ultra-Fine Grained 5083 Aluminium Alloy Produced by Accumulative Roll-Bonding N. Tsuji, K. Shiotsuki, H. Utsunomiya and Y. Saito	73
Formation of Microcrystalline Structures and Superplastic Properties of Nickel Based Alloys V. Valitov, F.Z. Utyashev and S.K. Mukhtarov	79
Superplastic Properties of Rapidly Solidified Mg-Al-Zn Alloys J. Kaneko, M. Sugamata and N. Hisata	85
Superplasticity of Ultrafine-Grained Aluminium Alloys Processed by Equal-Channel Angular Pressing Z. Horita, S. Komura, P.B. Berbon, A. Utsunomiya, M. Furukawa, M. Nemoto and T.G. Langdon	91
Optimization of Microstructure for Superplasticity Using Equal-Channel Angular Pressing M. Furukawa, K. Oh-ishi, S. Komura, A. Yamashita, Z. Horita, M. Nemoto and T.G. Langdon	97
Effect of Cold Pre-Rolling on Superplasticity of Nonrecrystallized 7075 Aluminium Alloy X.Y. Yang, H. Miura and T. Sakai	103
Microstructure and Superplastic Properties in an ECAE Al-4Mg-0.5Sc Alloy Processed at Elevated Temperatures T. Mukai, T.G. Nieh, H. Watanabe and K. Higashi	109
Grain Refining during Heavy Deformation in Fe-C Alloys with (α+θ) Two-Phase Structure H. Hidaka, T. Suzaki, Y. Kimura and S. Takaki	115
Superplasticity of Sintered Titanium Alloy with Martensitic Structure K. Okazaki, T. Tsuchiyama, N. Nakamura and S. Takaki	121
Microstructure Change during Superplastic Deformation in (α+γ) Duplex Stainless Steel T. Yamazaki, Y. Mizuno, T. Furuhashi and T. Maki	127
Microstructure Control for Superplasticity of an Ultra-High Carbon Steel E. Sato, S. Furimoto, T. Furuhashi, K. Tsuzaki and T. Maki	133
Atom-Scale Characterization of Ordered Alloys with Atom-Probe Field-Ion Microscope M. Yamamoto	139
Superplastic Deformation Mechanisms of Monolithic Intermetallics W.-. Kim, Y. Sato, S. Semboshi, S. Hanada and H. Kokawa	147
Microstructural Evolution during Superplastic Deformation in Large-Grained Iron Aluminides D.L. Lin and Y. Liu	155

High-Temperature Deformation in Ti-62.5at.%Al Single Crystals Containing Small Al₂Ti-Type Precipitates	
Y. Umakoshi, T. Nakano and K. Ashida	163
Recent Advances in Superplastic Intermetallics with Emphasis on Titanium and Iron Aluminides	
T.G. Nieh and J. Wadsworth	169
Modelling Heterogeneous Microstructures, Inhomogeneous Deformation and Failure in Superplasticity	
F.P.E. Dunne and T.W. Kim	177
Superplasticity Assisted by Stress-Induced Phase Transformation in Ti-5.5Al-1Fe Alloy	
J. Koike, Y. Shimoyama, T. Okamura and K. Maruyama	183
Superplastic Deformation without Relative Grain Translation?	
P.L. Blackwell and P.S. Bate	189
Low-Temperature Superplasticity of Submicrocrystalline Intermetallics	
R.M. Imayev, G.A. Salishchev, M.R. Shagiev, V.M. Imayev, N.K. Gabdullin, A.V. Kuznetsov, O.N. Senkov and F.H. Froes	195
Superplasticity in Titanium Aluminides Containing Chromium	
K. Niinobe, Y. Tomota, T. Tsujimoto and M. Nobuki	201
Now and Future in High-Strain-Rate Superplasticity	
K. Higashi and M. Mabuchi	209
Theoretical Investigation of High Strain Rate Superplasticity	
V.N. Perevezentsev, K. Higashi and J.V. Svirina	217
Recent Research and Development Activities on Superplasticity in Taiwan	
J.C. Huang and T.H. Chuang	225
Deformation and Microstructural Development in a 2124Al/SiC_p MMC during High Strain Rate Superplasticity	
G.H. Zahid, R.I. Todd and P.B. Prangnell	233
Threshold Stress in High Strain Rate Superplasticity of Powder Metallurgy Aluminum Alloys and Composites	
D.W. Kum and W.J. Kim	241
Temperature Dependence of Tensile Elongation in a Mechanically Milled, P/M Al-Mg-Cu Alloy	
T. Hasegawa and K. Okazaki	249
Effect of Deformation Temperature on High Strain Rate Superplastic Properties in PM 2024Al-Fe-Ni Alloys	
K. Matsuki, T. Aida and J. Kusui	255
Phenomenology and Application of Low Temperature and High Strain Rate Superplasticity in Aluminium Alloy 1420	
M.V. Markushev and M.Y. Murashkin	261
Superplastic Deformation of Aluminum Systems at 500-650 °C with or without Presence of Liquid Phase	
C.S. Liao, B.Y. Lou, C.Y. Chen, J.C. Huang, P.W. Kao and W.H. Huang	267
Role of Subgrain Formation in High Strain Rate Superplasticity of Al-Mg Alloy	
W.J. Kim	273
High Strain Rate Superplasticity in Magnesium Matrix Composites Containing 15-20 vol. % AlN Particulate	
A.-. Ma, T. Imura, M. Takagi, Y. Nishida, J.H. Jiang, T. Imai, S.W. Lim and J.Q. Jiang	279
High Strain Rate Superplasticity in 10vol.% SiC Particulate Reinforced AZ31 Magnesium Alloys	
A.-. Ma, J.Q. Jiang, J.H. Jiang, Y.-. Sun, Y. Nishida, T. Imai, P.-. Chen, T. Imura and M. Takagi	285
The Thickness of Liquid Phase during Superplastic Deformation in the Vicinity of Solidus Temperature for a 7475 Aluminum Alloy	
Y. Takayama, T. Tozawa and H. Kato	291
Observation of High-Strain-Rate Superplasticity in ZK60 and SiCp/ZK60 Composite	
H. Watanabe, T. Mukai, T.G. Nieh and K. Higashi	297
Low Temperature Superplastic Behavior in ZK60 Magnesium Alloy	
H. Watanabe, T. Mukai and K. Higashi	303
High Strain Superplastic Forming of a New Al-Mg Alloy	
H. Uchida, M. Asano and H. Yoshida	309

Superplasticity of Ceramic Particulate Reinforced Magnesium Alloy Composite Made by a Vortex Method	315
T. Imai, S.W. Lim, D. Jiang, Y. Nishida and T. Imura	
Superplasticity of a SiC_p/Al-10wt% Ti Composite at High Strain Rates	321
H. Kim, W.T. Kim and D.W. Kum	
High Strain Rate Superplasticity of a Powder Metallurgy Pure Aluminum 1N90	327
S. Kojima, D. Jiang, J. Mao and T. Imai	
Microstructural Dynamics during High-Strain-Rate Superplastic Flow in PM 7475 Alloy	333
T. Hirata, T. Mukai, N. Saito, M. Kohzu, S. Tanabe and K. Higashi	
Rheological Behavior of Superplastic Nanocrystalline and Amorphous Materials	341
O.M. Smirnov	
Superplasticity in Pd₄₀Ni₄₀P₂₀ Metallic Glass	349
Y. Kawamura, T. Nakamura and K.B. Kim	
Low-Temperature Homogeneous Deformation in Amorphous Alloys Induced under Electropulsing	355
H. Mizubayashi and T. Okamoto	
Superplastic Behavior and Microstructure in Amorphous La₅₅Al₂₅Ni₂₀ Alloy	361
T. Ohkubo, T. Hiroshima, S. Ochiai, Y. Hirotsu, W. Fujitani, Y. Umakoshi and K.B. Kim	
Ni Tracer Diffusion in Bulk Metallic Glass Zr₅₅Al₁₀Cu₂₅	367
H. Nakajima, K. Nonaka, T. Kojima, T. Zhang and K.B. Kim	
Superplastic Forming of Zr₆₅Al₁₀Ni₁₀Cu₁₅ Metallic Glass	373
Y. Kawamura and K.B. Kim	
Superplasticity in La₅₅Al₂₀Ni₂₅ Metallic Glass	379
T. Nakamura, Y. Kawamura and K.B. Kim	
The Role of Interfaces in the High Temperature Deformation and Failure of Polycrystalline Alumina	387
A.H. Chokshi	
Stress Relaxation and Brittle-Ductile Transition in Superplastic Ceramics	395
T. Rouxel	
Investigation of Superplasticity in 3Y-TZP by Stress Relaxation	403
J.R. Seidensticker and S.M. Wiederhorn	
Mechanics of Superplastic Deformations at Atomic Scale	411
N. Chandra	
Grain Boundary Engineering for Superplasticity	421
T. Watanabe	
Cavity Damage Accumulation in Alumina Doped with Zirconia or Magnesia	431
K. Hiraga, K. Nakano, T. Suzuki and Y. Sakka	
An Amorphous Ceramic Fiber with Large Viscous Flow Deformation at 1193 K	437
Y. Waku, H. Ohtsubo and K.B. Kim	
Superplastic Deformation of Cubic Zirconia Ceramics with Intergranular Phases	443
A.A. Sharif, P.H. Imamura and M.L. Mecartney	
High Strain Rate Superplasticity in Ceramics	451
M. Oka, N. Tabuchi and T. Takashi	
Alumina Segregation at Grain Boundaries in Superplastic Y-TZP	459
E. Sato, H. Morioka, K. Kuribayashi and D. Sundararaman	
Liquid Phase Sintering of Y-TZP with CuO and Y₂Cu₂O₅ Dopants	465
M. Hayakawa, T. Inoue, J.H. Pee, T. Onda, H. Suematsu and H. Yamauchi	
Effect of Divalent Elements on the Grain Growth of TZP	471
T. Onda, K. Okazaki, H. Suematsu, H. Yamauchi and M. Hayakawa	
Improvement of Mechanical Properties after Superplastic Deformation of Silicon Nitride	477
T. Nishimura, G.D. Zhan, M. Mitomo and H. Sato	
Superplastic Characteristics of TZP Containing Various Amounts of SiO₂	483
N. Furushiro, W. Fujitani, K. Oda and Y. Umakoshi	
Superplastic Tensile Ductility in a Zirconia-Dispersed Alumina Produced by Colloidal Processing	489
T. Suzuki, Y. Sakka, K. Nakano and K. Hiraga	
High Temperature Compressive Deformation Behavior of Superplastic B, C-SiC	495
Y. Shinoda, T. Nagano, H. Gu and F. Wakai	

High Temperature Deformation of Precursor Derived Si-C-N Ceramics S. Ishihara, F. Aldinger and F. Wakai	501
Tensile Ductility of Liquid-Phase Sintered β-Silicon Carbide at Elevated Temperature T. Nagano, H. Gu, Y. Shinoda, G.D. Zhan, M. Mitomo and F. Wakai	507
High Temperature Deformation of Mullite-Zirconia Ceramics Consolidated from Rapidly Solidified Powder H. Ito, K. Lucas, K. Takagi, K. Morino and I. Nakamoto	513
Effect of Boron and Carbon Addition on High Temperature Deformation Behavior of β-Silicon Carbide K. Kawahara, S. Tsurekawa and H. Nakashima	519
TEM In-Situ Observation of SiO_2 Doped TZP at High Temperatures Y. Ikuhara, Y. Nagai, T. Yamamoto and T. Sakuma	525
Superplasticity in Zirconia and Yttria Stabilized Zirconia Mixed Powders K. Sasaki, Y. Ikuhara and T. Sakuma	531
Superplasticity in Multi-Phase Alumina-Based Composites A. Foucault, Y. Takigawa, Y. Ikuhara and T. Sakuma	537
Superplasticity in GeO_2-Doped TZP J. Mimurada, T. Kondo, Y. Takigawa, Y. Ikuhara and T. Sakuma	543
The Influence of the Threshold Stress in the Superplastic Flow of YSZP M. Jiménez-Melendo and A. Domínguez-Rodríguez	549
Direct Atomistic Observation of Grain Boundary Sliding I. Gold T. Kizuka, M. Mizutani, S. Deguchi and M. Naruse	555
Direct Atomistic Observation of Grain Boundary Sliding II. Silicon Including Boundary Glass Phase T. Kizuka, K. Hosoki, S. Deguchi and M. Naruse	561
Boundary Structure of Y-ZrO₂ Grains as Derived from High-Resolution Electron Microscopy A. Kumao, N. Nakamura, H. Endoh, Y. Okamoto and M. Suzuki	567
Grain Boundary Geometry of Superplastic Silicon Carbide Ceramic H. Miyazaki, S. Shimizu, T. Iseki, K. Yasuda, T. Yano and M. Mitomo	573
Grain Boundary Character Distribution Control of Al-Mg Alloys by Hot Extrusion N. Saito, M. Mabuchi, M. Nakanishi, M. Nakamura and K. Higashi	579
Effect of Magnetic Field on Sintering of Iron Powder Compact T. Matsuzaki, T. Sasaki, S. Tsurekawa and T. Watanabe	585
Effect of Grain Boundary Microstructure on Superplastic Deformation of Al-Li-Cu-Mg-Zr Alloy S. Kobayashi, T. Yoshimura, S. Tsurekawa and T. Watanabe	591
Atomic Structure and Electron Structure of Fine Grained Diamond Boundaries H. Ichinose, M. Nakanose and M. Khoyama	597
Grain Boundary Energy and Atomic Structure in Alumina Bicrystals T. Watanabe, H. Yoshida, T. Saito, T. Yamamoto, Y. Ikuhara and T. Sakuma	601
Initiation and Early Stages of Cavity Growth during Superplastic and Hot Deformation A.K. Ghosh, D.H. Bae and S.L. Semiatin	609
Modelling of Superplastic Forming Using the Finite Element Method R.S. Sadeghi and Z. Pursell	617
Superplastic Forging Analysis by the Multi-Level Modeling T. Aizawa	621
Multiaxial Experiments and Constitutive Modeling of Superplasticity E. Tanaka, S. Murakami, H. Takasaki and H. Iwasaki	631
Microstructure Evolution in 5083 Al-Mg Alloy Exhibiting Low Temperature Superplasticity at 250°C I.C. Hsiao and J.C. Huang	639
The Role of Liquid Phase in Cavitation and Fracture in High-Strain-Rate Superplastic $\text{Si}_3\text{N}_4/\text{Al}$ Alloy Composite H. Iwasaki, M. Mabuchi and K. Higashi	645
Mechanism of Internal Stress Superplasticity Based on Thermally-Activated Kinetics K. Kitazono, E. Sato and K. Kuribayashi	651

Finite Element Method Simulation of Grain Boundary Sliding: Its Purposes, Models and Applications in Fine-Grain Superplasticity M. Tokuda and R. Hu	657
Crack-Like Cavitation in a 0.3 wt% SiO₂-Doped Tetragonal Zirconia K. Morita, Y. Sakka and K. Hiraga	663
Anisotropic Feature of Fracture Toughness in Superplastically Deformed 3Y-TZP Y. Motohashi, M. Nemoto, K. Funami and T. Sakuma	669
Effect of Deformation Schedule on Cavitation in Superplastic 7475 Al Alloy H. Iwasaki, T. Mori and K. Higashi	675
A Comparative Study of Cavitation Characteristics in Si₃N_{4w}/Al-Mg-Si Composite H. Iwasaki, T. Mori, M. Mabuchi and K. Higashi	681
Effect of Grain Boundary Microstructures of Brittle Fracture in Polycrystalline Molybdenum S. Tsurekawa, S. Kokubun and T. Watanabe	687
Simple Evaluation of Superplastic Characteristic by Tensile Test Using R-Type Specimen M. Hirohashi and M. Nishizawa	693
Cavitation in Coarse-Grained Al-4.5Mg Alloys Exhibiting Superplastic-Like Behavior H. Hosokawa, H. Iwasaki, T. Mori, M. Mabuchi, T. Tagata and K. Higashi	699
Positron Annihilation Study of the Cavitation in 5083 Superplastic Aluminum Alloy H. Araki, E. Fujita, S. Nakata and Y. Shirai	705
A Technique to Study the Granular Flow during Superplastic Deformation J.D. Muñoz-Andrade, A. Mendoza-Allende, G. Torres-Villaseñor and J.A. Montemayor-Aldrete	711
Forming of Ceramics at Elevated Temperatures R. Janßen, R. Kauermann and N. Claussen	719
Superplasticity of YTZP: Application to the Joining of Ceramics A. Domínguez-Rodríguez and M. Jiménez-Melendo	727
An Analytical Model of the Superplastic Bulge Forming of Sheet Metal T. Usugi, N. Akkus, M. Kawahara and H. Nishimura	735
Different Friction Coefficients at Different Positions of Superplastically Formed Parts T.-. Chen, J.C. Huang, Y.M. Hwang and T.D. Wang	741
On Superplastic Forming of Pure Titanium for Constructing Dental Implants A. Kamiya, A. Watazu, T. Nonami, T. Sonoda, T. Kameyama and K. Naganuma	747
Superplastic Forming of Corrosion Resistant CuZnSn Alloys R. Matsubara, N. Ashie, K. Nakamura and S. Miura	753
Influence of Preforming on the Final Thickness Distribution of the Superplastically Deformed Domes N. Akkus, K. Suzuki, M. Kawahara and H. Nishimura	759
Mathematical Modeling of Superplastic Forming of a Long Rectangular Box Section R.A. Vasin, F.U. Enikeev and R.V. Safiullin	765
Fabrication of High-Performance Aluminum Components Using High Strain Rate Superplasticity N. Kuroishi	771
The Numerical Analysis on Superplastic Forming under Plane Strain for 7475 Al-Alloy N. Suzuki, M. Kohzu, S. Tanabe and K. Higashi	777
Superplastic Aluminum Forming - Expanding Its Techno-Economic Niche A.J. Barnes	785
Development of Superplastic-Aluminum-Alloy Piston Formed with Controlled Forging Technology H. Yamagata	797
Superplastic Forming Manufacturing Technology Moves Towards the Twenty-First Century D.G. Sanders	805
Influence of Lubrication on Aluminum Superplastic Forming K. Osada and K. Shirakawa	813
Products Development of Superplastic 5083 Alloy 'ALNOVI-1' Y. Onishi	819
New Type Aluminum Alloys with Higher Strength J. Nagahora, K. Kita and K. Ohtera	825

Superplastic Forming of Aerospace Metallic Materials

T. Tsuzuku

831

High-Strain-Rate Superplasticity of Al-Si Alloy Produced by Powder Metallurgical Processing

N. Kuroishi, S. Tsuboi, S. Fujino, Y. Shiomi and K. Matsuki

837