

4th International Conference on Advances in Solidification Processes (ICASP-4)

IOP Conference Series: Materials Science and Engineering
Volume 117

Windsor, United Kingdom
8 - 11 July 2014

ISBN: 978-1-5108-2232-0
ISSN: 1757-8981

Printed from e-media with permission by:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571



Some format issues inherent in the e-media version may also appear in this print version.

Copyright© (2014) by the Institute of Physics
All rights reserved. The material featured in this book is subject to
IOP copyright protection, unless otherwise indicated.

Printed by Curran Associates, Inc. (2016)

For permission requests, please contact the Institute of Physics
at the address below.

Institute of Physics
Dirac House, Temple Back
Bristol BS1 6BE UK

Phone: 44 1 17 929 7481
Fax: 44 1 17 920 0979

techtracking@iop.org

Additional copies of this publication are available from:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: 845-758-0400
Fax: 845-758-2633
Email: curran@proceedings.com
Web: www.proceedings.com

Table of contents

Volume 117

**4th International Conference on Advances in Solidification Processes (ICASP-4)
8–11 July 2014, Windsor, UK**

Accepted papers received: 22 February 2016

Published online: 31 March 2016

Preface

011001

OPEN ACCESS

[4th International Conference on Advances in Solidification Processes \(ICASP-4\)](#)

011002

OPEN ACCESS

[ICASP-4 Committees](#)

011003

OPEN ACCESS

[Peer review statement](#)

Paper

Nucleation and Grain Refinement

012001

OPEN ACCESS

[The effect of the melt thermal gradient on the size of the constitutionally supercooled zone](#)

A Prasad, L Yuan, P D Lee, M Easton and D StJohn pg. 1

012002

OPEN ACCESS

[The interface of heterogeneous nucleation on single crystal substrates](#)

L Yang, M Xia and J Li pg. 8

012003

OPEN ACCESS

[Validated thermodynamic prediction of AIP and eutectic \(Si\) solidification sequence in Al-Si cast alloys](#)

S M Liang and R Schmid-Fetzer pg. 15

012004

OPEN ACCESS

[Property enhancement by grain refinement of zinc-aluminium foundry alloys](#)

W K Krajewski, A L Greer, G Piwowarski and P K Krajewski pg. 22

012005

OPEN ACCESS

[The critical effect of Fe on the grain refinement of aluminium via Al-5Ti-1B addition](#)

Y Zhang and N Ma pg. 28

012006

OPEN ACCESS

[Heterogeneous nucleation of entrained eutectic Si in high purity melt spun Al-Si alloys investigated by entrained droplet technique and DSC](#)

J H Li, M Albu, T H Ludwig, F Hofer, L Arnberg and P Schumacher pg. 34

Dendritic Growth

012007

OPEN ACCESS

[Phase-field modelling of \$\beta\$ \(Ti\) solidification in Ti-45at.%Al: columnar dendrite growth at various gravity levels](#)

A Viardin, R Berger, L Sturz, M Apel and U Hecht pg. 40

012008

OPEN ACCESS

[Three-dimensional modeling of a thermal dendrite using the phase field method with automatic anisotropic and unstructured adaptive finite element meshing](#)

C Sarkis, L Silva, Ch-A Gandin and M Plapp pg. 47

012009

OPEN ACCESS

[CAFE simulation of columnar-to-equiaxed transition in Al-7wt%Si alloys directionally solidified under microgravity](#)

D R Liu, N Mangelinck-Noël, Ch-A Gandin, G Zimmermann, L Sturz, H Nguyen Thi and B Billia pg. 55

012010

OPEN ACCESS

[Modelling Al-4wt.%Cu as-cast structure using equiaxed morphological parameters deduced from in-situ synchrotron X-ray radiography](#)

M Ahmadein, M Wu, G Reinhart, H Nguyen-Thi and A Ludwig pg. 61

012011

OPEN ACCESS

[Numerical investigation of solidification and CET of the transparent alloy NPG-37.5 wt.% DC in microgravity "TRACE" experiment](#)

M Ahmadein, M Wu, L Sturz, G Zimmermann and A Ludwig pg. 68

012012

OPEN ACCESS

[Sensitivity analysis of dendritic growth kinetics in a Bridgman furnace front tracking model](#)

R P Mooney and S McFadden pg. 75

012013

OPEN ACCESS

[Mesoscopic modelling of columnar solidification](#)

M Založnik, A Viardin, Y Souhar, H Combeau and M Apel pg. 82

012014

OPEN ACCESS

[The role of the stagnant-film thickness in mesoscopic modeling of equiaxed grain envelopes](#)

Youssef Souhar, Valerio F. De Felice, Miha Založnik, Hervé Combeau and Christoph Beckermann pg. 89

012015

OPEN ACCESS

[Bent dendrite growth in undercooled Fe-B alloy melts](#)

C Karrasch, T Volkmann, J Valloton, M Kolbe and DM Herlach pg. 95

012016

OPEN ACCESS

[A simple model for spherical growth in alloy solidification](#)

Z Fan and S Z Lu pg. 100

Intermetallic Formation

012017

OPEN ACCESS

[The influence of cooling rate and Fe/Cr content on the evolution of Fe-rich compounds in a secondary Al-Si-Cu diecasting alloy](#)

A Fabrizi and G Timelli pg. 108

012018

OPEN ACCESS

[3D characterization by tomography of beta \$Al_9Fe_2Si_2\$ phase precipitation in a \$Al_{6.5}Si_{1}Fe\$ alloy](#)

D Ferdian, L Salvo, J Lacaze, C Tenailleau, B Duployer and B Malard pg. 114

012019

OPEN ACCESS

[Formation of intermetallic phases in AlSi7Fe1 alloy processed under microgravity and forced fluid flow conditions and their influence on the permeability](#)

S Steinbach, L Ratke, G Zimmermann and O Budenkova pg. 120

012020

OPEN ACCESS

[Impurity effects on the solidification of primary Al₃\(Sc,Zr\) phase in Al alloys](#)

J H Li and P Schumacher pg. 126

Eutectic, Peritectic and Monotectic Solidification

012021

OPEN ACCESS

[Modification of Ohnaka back diffusion equation](#)

A Turkeli pg. 132

012022

OPEN ACCESS

[The influence of Cu, Mg and Ni on the solidification and microstructure of Al-Si alloys](#)

A Darlapudi, S D McDonald and D H StJohn pg. 138

012023

OPEN ACCESS

[In situ synchrotron study of liquid phase separation process in Al-10 wt.% Bi immiscible alloys by radiography and small angle X-ray scattering](#)

W Q Lu, S G Zhang and J G Li pg. 145

012024

OPEN ACCESS

[Misorientations in spheroidal graphite: some new insights about spheroidal graphite growth in cast irons](#)

J Lacaze, K Theuwissen, L Laffont and M Véron pg. 152

012025

OPEN ACCESS

[Microstructures in a ternary eutectic alloy: devising metrics based on neighbourhood relationships](#)

A Dennstedt, A Choudhury, L Ratke and B Nestler pg. 158

Microstructure Formation

012026

OPEN ACCESS

[Use of a phenomenological chemical scale for the identification of high distribution coefficient impurities within the ITS-90](#)

D H Lowe pg. 165

012027

OPEN ACCESS

[Effects of TiB₂ particles and Ag on the activation energy of \$\Omega\$ phase in Al alloys](#)

F Melotti, T Hirst, A Dustan and W D Griffiths pg. 171

012028

OPEN ACCESS

[Correlation between microstructure and hardness of a Bi-1.5wt%Ag lead-free solder alloy](#)

J E Spinelli, R A Macedo, B L Silva and A Garcia pg. 177

012029

OPEN ACCESS

[Applications of the directional solidification in magnetic shape memory alloys](#)

Y J Huang, J Liu, Q D Hu, Q H Liu, I Karaman and J G Li pg. 184

012030

OPEN ACCESS

[Crystallographic investigation of grain selection during initial solidification](#)

H Esaka, Y Kataoka and K Shinozuka pg. 190

012031

OPEN ACCESS

[Aging characteristics of the Al-Si-Cu-Mg cast alloy modified with transition metals Zr, V and Ti](#)

F Czerwinski, S K Shaha, W Kasprzak, J Friedman and D L Chen pg. 195

Advanced Solidification Processing

012032

OPEN ACCESS

[A meshless approach to thermomechanics of DC casting of aluminium billets](#)

B Mavrič and B Šarler pg. 203

012033

OPEN ACCESS

[BaZrO₃ refractory applied to the directional solidification of TiAl alloys](#)

J He, C Wei, S Wang, D Meng, X Lu, H Wang and C Li pg. 210

012034

OPEN ACCESS

[Effect of cerium addition on casting/chill interfacial heat flux and casting surface profile during solidification of Al-14%Si alloy](#)

V Vijeesh and K N Prabhu pg. 217

012035

OPEN ACCESS

[Effect of Ce melt treatment on solidification path of ZA8 alloy](#)

R Sudheer, V Vijeesh and K N Prabhu pg. 224

012036

OPEN ACCESS

[Numerical simulation on the solidification structure of Ø600mm continuous casting round bloom](#)

Q Fang, H W Ni, S J Wang and H Zang pg. 231

012037

OPEN ACCESS

[Numerical simulation of casting process to assist in defects reduction in complex steel tidal power component](#)

E J Guo, S C Zhao, L P Wang, T Wu, B P Xin, J J Tan and H L Jia pg. 237

012038

OPEN ACCESS

[Surface formation in direct chill \(DC\) casting of 6082 aluminium alloys](#)

N Bayat and T Carlberg pg. 244

012039

OPEN ACCESS

[The role of \$TiB_2\$ in strengthening \$TiB_2\$ reinforced aluminium casting composites](#)

Z Chen, H Kang, Y Zhao, Y Zheng and T Wang pg. 250

012040

OPEN ACCESS

[Study on rheo-diecasting process of 7075R alloys by SA-EMS melt homogenized treatment](#)

G Zhihua, X Jun, Z Zhifeng, L Guojun and T Mengou pg. 257

012041

OPEN ACCESS

[On the role of solidification modelling in Integrated Computational Materials Engineering "ICME"](#)

G J Schmitz, B Böttger and M Apel pg. 263

012042

OPEN ACCESS

[Studies on synthesis of in-situ Al-TiC metal matrix composites](#)

R N Rai, S C Saha, G L Datta and M Chakraborty pg. 269

Solidification Under External Fields

012043

OPEN ACCESS

[The effect of rotating magnetic field on the microstructure of in situ TiB₂/Cu composites](#)

C Zou, H Kang, R Li, M Li, W Wang, Z Chen and T Wang pg. 276

012044

OPEN ACCESS

[Numerical simulation on level fluctuation in bloom casting mold with electromagnetic stirring](#)

H Zhang, H W Ni, Y Li and Z F Zhao pg. 283

012045

OPEN ACCESS

[Influence of forced convection on solidification and remelting in the developing mushy zone](#)

M Wu, A Vakhrushev, A Ludwig and A Kharicha pg. 290

012046

OPEN ACCESS

[Control of solidification microstructure using programmable electro-magnetic pulses](#)

T Manuwong, W Zhang, P L Kazinczi and J Mi pg. 297

012047

OPEN ACCESS

[Effect of electromagnetic vibration on the microstructure of direct chill cast Al-Zn-Mg-Cu alloy](#)

Y Zuo, X Fu, Q Zhu, L Li, P Wang and J Cui pg. 304

012048

OPEN ACCESS

[Microstructure refinement of commercial 7xxx aluminium alloys solidified by the electromagnetic vibration technique](#)

M Li, T Tamura, N Omura, Y Murakami and S Tada pg. 311

012050

OPEN ACCESS

[Grain Refinement of an Al-2 wt%Cu Alloy by Al₃Ti1B Master Alloy and Ultrasonic Treatment](#)

E Q Wang, G Wang, M S Dargusch, M Qian, D G Eskin and D H StJohn pg. 318

012051

OPEN ACCESS

[Convection and solidification influenced by thermo-electric effect](#)

J Wang, G S Abou-Jaoude, O Budenkova, G Reinhart, N Mangelinck, X Li, H Nguyen-Thi, Z-M Ren and Y Fautrelle pg. 325

012052

OPEN ACCESS

[A multiphysics and multiscale model for low frequency electromagnetic direct-chill casting](#)

N Košnik, A Z Guštin, B Mavrič and B Šarler pg. 331

Rapid Solidification

012053

OPEN ACCESS

[Rapidly solidified Ag-Cu eutectics: A comparative study using drop-tube and melt fluxing techniques](#)

Y Yu, A M Mullis and R F Cochrane pg. 338

012054

OPEN ACCESS

[The origins of spontaneous grain refinement in deeply undercooled metallic melts](#)

A M Mullis, E G Castle and R F Cochrane pg. 344

012055

OPEN ACCESS

[Dendrite growth morphologies in rapidly solidified Al-4.5wt.%Cu droplets](#)

M Bedel, G Reinhart, A-A Bogno, H Nguyen-Thi, E Boller, Ch-A Gandin and H Henein pg. 350

012056

OPEN ACCESS

[Phase field crystal modelling of the order-to-disordered atomistic structure transition of metallic glasses](#)

W Zhang and J Mi pg. 356

012057

OPEN ACCESS

[Solidification of single droplets under combined cooling conditions](#)

N Ellendt, N Ciftci, C Goodreau, V Uhlenwinkel and L Madler pg. 363

012058

OPEN ACCESS

[Effect of convection on the dendrite growth kinetics in undercooled melts of D2 tool steels](#)

J Valloton, D M Herlach and H Henein pg. 370

012059

OPEN ACCESS

[Instability of nanoscale metallic particles under electron irradiation in TEM](#)

X Y Chen, S G Zhang, M X Xia and J G Li pg. 375

Defect Formation

012060

OPEN ACCESS

[Criterion function for predicting freckles in CMSX-4 during directional solidification](#)

B Pustal, D Ma, N Warnken, E Subasic, J Jakumeit and A Bührig-Polaczek pg. 380

012061

OPEN ACCESS

[Numerical study of influence of inclusion movement on channel segregation in Fe- 0.21 wt% C- 0.1 wt% S alloy](#)

D R Liu, Z P Yang, Q Y Sun, L P Wang and B X Ma pg. 386

012062

OPEN ACCESS

[Simple metrics for verification and validation of macrosegregation model predictions](#)

I Vušanović and V R Voller pg. 393

012063

OPEN ACCESS

[Effect of the dendritic morphology on hot tearing of carbon steels](#)

M R Ridolfi pg. 399

012064

OPEN ACCESS

[Effect of superheat on macrostructure and macrosegregation in continuous cast low-alloy steel slabs](#)

T Pikkarainen, V Vuorenmaa, I Rentola, M Leinonen and D Porter pg. 405

012065

OPEN ACCESS

[The behaviour of entrainment defects formed in commercial purity Mg alloy cast under a cover gas of SF₆](#)

T Li and W D Griffiths pg. 412

012066

OPEN ACCESS

[The effect of alloy elements on the density variation of steel melt at the interdendritic region during solidification](#)

Y F Cao, Y Chen, X P Ma, P X Fu, X H Kang, H W Liu and D Z Li pg. 419

012067

OPEN ACCESS

[*In situ* X-ray observations of gas porosity interactions with dendritic microstructures during solidification of Al-based alloys](#)

A G Murphy, D J Browne, Y Houltz and R H Mathiesen pg. 426

012068

OPEN ACCESS

[Analysis and simulation of non-metallic inclusions in spheroidal graphite iron](#)

B Pustal, B Schelnberger and A Bührig-Polaczek pg. 432

012069

OPEN ACCESS

[Three dimensional simulation of macrosegregation in steel billets by a meshless method](#)

R Vertnik and B Šarler pg. 438

012070

OPEN ACCESS

[Oxide film defects in Al alloys and the formation of hydrogen- related porosity](#)

W D Griffiths, A J Gerrard and Y Yue pg. 445