

Table of Contents

Preface

A Short History of MIT Studies on Fluid Flow in Solidification, 1952- 2009

Chapter 1: Materials Development and Characterisation

Variation of Microstructure and Mechanical Properties of ZW61 Magnesium Alloy Solidified under Different Pressures S.S. Wu, X.G. Fang, S.L. Lü, L.F. Liu and W. Guo	3
Short-Term Oxidation Behavior, Microstructure Evolution and Compression Behavior of Nickel-Based Superalloy GH4037 in Solid and Semi-Solid States G.F. Xiao, J.F. Jiang, Y. Wang, Y.Z. Liu, Y. Zhang and M.J. Huang	11
Heat-Resistant Al-Alloys with Quasicrystalline and L1₂- Precipitates F. Zupanič and T. Bončina	26
Using Micro-CT Scanning to Quantitative Characterize Porosity in High Pressure Die Castings and Semi-Solid Castings S.P. Midson	33
Effect of the Mg₃N₂ Sub-Micron Particle on the Grain Refinement of AZ80 Alloy J. Li, M. Pammer, E. Neunteufl and P. Schumacher	45
Effect of Solute Ta on Grain Refinement of Al-7Si-0.3Mg Based Alloys I. Spacil, D. Holec, P. Schumacher and J. Li	54
Role of Iron-Rich Phases and Porosity on the Ductility of Rheocast Al-Mg-Si-Alloys Q. Zhang, S. Jonsson, A.K. Dahle and A.E.W. Jarfors	65
Effect of Homogenization Annealing on Wear Properties of Thixo-Extruded Copper Alloy Y.X. Cui, H. Xiao, C. Xiong, R.F. Zhou, Z.L. Li and Y.K. Li	71
Dependence of Microstructures and Mechanical Properties on the Growth Rate and Composition in Directionally Solidified Mg-Gd Alloys H. Qin, G.Y. Yang, S.F. Luo, T. Bai and W.Q. Jie	82
A II-Shaped Curve of Hot Tearing Susceptibility in Magsimal®-59-Based Alloys B. Hu, D.J. Li and X.Q. Zeng	98
Phase Transformation of M2 High Speed Steel during Semi-Solid Cooling and Conventional Cooling T. Sun, Y.J. Wang, R.B. Song, Y.Z. Liu, J. Yanagimoto and T. Taylor	105
Bending Strength and Fracture Behaviour of Metal-Ceramic Interpenetrating Phase Composites Manufactured by Using Semi-Solid Forming Technology L. Schomer, K.R. Riedmüller and M. Liewald	111

Chapter 2: Rheology, Modelling and Simulation

Visco-Elastic Properties of Semi-Solid Alloys M. Tocci, A. Pola and M. Modigell	119
Understanding the Rheological Transitions in Semi-Solid Alloys by a Combined <i>In Situ</i> Imaging and Granular Micromechanics Modeling Approach T.C. Su, C. O'Sullivan, H. Yasuda and C.M. Gourlay	127
Experimental and Numerical Study of the Effect of Pouring Temperature and Fluid Convection on Spherical Grains Formation W.Y. Qu, X.G. Hu, M. Luo and Q. Zhu	133
Effects of Grain Morphology on Flow Behavior of Semi-Solid Slurries M. Luo, D.Q. Li, H.X. Lu, W.Y. Qu, H. Zhang, L. Cheng and Q. Zhu	140

Chapter 3: Development of Industrial Processes and Technologies

Structure Optimization of Semi-Solid Die Cast Steering Knuckle and its Experiment Verification	
S. Chen, D.Q. Li, F. Zhang, X.K. Liang, J. Feng and T. Li	149
Effect of Runner Distance on Microstructure and Properties of Semi-Solid Squeeze Casting CuSn10P1 Alloy	
Y.K. Li, P.L. Cai, Z.L. He, R.F. Zhou, L. Li, X. Wu and H. Xiao	156
Industrialization of Aluminum Alloy Uniform Solidification Controlled Rheological Die Casting	
M.F. Qi, Y.L. Kang, Y.H. Zheng, J.C. Wang, G.N. Li and Y. Zhang	163
Semisolid Casting and Die Casting of Al-4.8%Mg-2%Si Alloy	
T. Haga, S. Imamura, R. Miwa and H. Fuse	172
Progress of Semi-Solid Processing of Alloys and Composites in China	
G. Li, M. Luo, W.Y. Qu, H.X. Lu, X.G. Hu and Q. Zhu	178
The Effect of Solution Time on the Microstructure of A356.2 Aluminum Alloy Provided by Rheocasting and Squeeze Casting	
L. Cheng, H.X. Lu, M. Luo, X.G. Li, W.P. Zhang and Q. Zhu	189
Properties of Semisolid Parts: Comparison with Conventional and Innovative Manufacturing Technologies	
P. Tonolini, A. Pola, L. Montesano, M. Tocci, M. Gelfi and G.M. La Vecchia	197
Using Recycled Materials for Semi- Solid Processing of Al-Si-Mg Based Alloys	
J. Li, X. Zhang, J. Winklhofer, S. Griesebner, B. Oberdorfer, W.Q. Jie and P. Schumacher	207
Preparation of Semi-Solid 357.0 Slurries with Different α-Al Phase Features by Solidification from Full Liquid State and Remelting	
J. Chen, X.G. Hu, W.Y. Qu, M. Luo, Z. Li, E.J. Dong and Q. Zhu	223
Manufacturing of Hybrid Al-Cu-Heatsinks by Combining Powder Pressing with Thixoforming	
M. Speth, M. Liewald, K.R. Riedmüller and L. Schomer	231
Recent Industrial Application and Perspectives of Rheo-Diecast Process in China	
D.Q. Li, X.K. Liang, F. Zhang, S. Chen, F. Zhang and J. Feng	238
Determination of the SSM Processing Window	
G.L. Brollo and E.J. Zoqui	244
Control of Amount of α-Al Phase Particles in near Eutectic Al-Si Alloy by Electromagnetic Stirring	
Y. Murakami and N. Omura	250
Effect of Serpentine Channel Pouring Process on the Microstructure of Semi-Solid 6061 Aluminum Alloy Slurry	
N.Y. Li, W.M. Mao, X.X. Geng and P.Y. Yan	255
Characterizing the Effect of Processing Parameters on Temperature Distribution of 7075 Aluminum Alloy Slurry Prepared by Enthalpy Control Process	
G. Li, J.K. Peng, E.J. Dong, J. Chen, H.X. Lu and Q. Zhu	263
About Residual Stress State of Castings: The Case of HPDC Parts and Possible Advantages through Semi-Solid Processes	
E. Fracchia, F.S. Gobber, C. Mus, Y. Kobayashi and M. Rosso	272
Semi-Solid 6061 Aluminum Alloy Slurry Prepared by Serpentine Channel Pouring Process and its Rheo-Diecasting	
N.Y. Li, W.M. Mao, X.X. Geng and P.Y. Yan	279
Semisolid Materials Processing: A Sustainability Perspective	
A.E.W. Jarfors, A.D. Di, G.G. Yu, J.C. Zheng, K.K. Wang and J. Wannasin	287
Recycling Al-Si Alloy by Semisolid Material Dragged during Continuous-Casting Strip Processing	
A. de Pádua Lima Filho, L.V.G. Ferreira, P.B. de Oliveira Neto, F. Hoisand, R.A.N. de Oliveira, W.J. Yamakami, M.A. Bazani and M. Borodiak	293
Cooling Curve Analysis of A356 Alloy by Conventional Casting and the Effect of Stirring	
G. Sanjuan-Sanjuan and Á.E. Chavez-Castellanos	300