

Table of Contents

Preface, Committee, Organiser and Supporters

Chapter 1: Plenary

Cost Effective Forging of Titanium Alloy Parts and their Mechanical Properties B. Gabbitas, F. Yang, S. Raynova and M.T. Jia	3
Processing of Titanium and its Alloys by Microwave Energy M.A. Imam, J. Feng, B.Y. Rock and A.W. Fliflet	11
The Additive Manufacturing (AM) of Titanium Alloys F.H. Froes and B. Dutta	19
Opportunities for the South African Foundry Industry in the Global Automotive Supply Chain M. Krieg and S. Cunningham	26
Magnesium Metal Production with Least CO₂ Emission N.R. Neelameggham and R.E. Brown	36

Chapter 2: Light Metals: Aluminium and Magnesium

Age-Hardening of Rheo-High Pressure Die Cast Al-Alloy 6066 C. Taute and H. Möller	47
The Effects of Natural Pre-Ageing Time on T6 Peak Hardness of R-HPDC 6xxx Series Alloys P. Daswa, H. Möller and G. Govender	55
Al-Mg-Si-(Cu) 6xxx Series Alloy Selection for Rheo-High Pressure Die Casting H. Möller, P. Daswa and G. Govender	61
Corrosion Behaviour of the Anodised A356 Aluminium Alloy Produced by the Rheo-High Pressure Die Casting Process L. Chauke, K. Mutombo and G. Govender	67
Rotational Rheology of A356 Semi-Solid Alloy at Low Solid Fractions A. Jabbari, S.A. Sadough and V. Pouyafar	74
Laser Beam Welding of Semi-Solid Rheocast Aluminium Alloy 2139 C.R. Gilbert	81
Microstructure Evolution in Melt Conditioned Direct Chill (MC-DC) Casting of Fe-Rich Al-Alloy H.R. Kotadia, J.B. Patel, H.T. Li, F. Gao and Z. Fan	90
Numerical Investigation of Cross-Section on Aluminum A6063 Thin-Walled Structures under Low-Velocity Impact Loading A. Taherkhani and A. Alavi Nia	96
<i>In Situ</i> Electron Microscopy Studies on the Tensile Deformation Mechanisms in Aluminium 5083 Alloy G.T. Motsi, P.A. Olubambi, T.J. Sono and L. Shoke	103
The Influence of Plate Gap on the Fatigue Properties of Friction Stir Welded AA5182-H111 and a Comparison with MIG Welding D.G. Hattingh, D. Bernard, L.G. von Wielligh and M.N. James	112
Closed-Loop Temperature Control of Material Plasticisation during Friction Stir Welding D.G. Hattingh, T.I. van Niekerk and R. Pothier	120
Cold Spray Technology for Light Metals and Porous Structures A. Hamweendo and I. Botef	126
Competitiveness of South African Foundries – A Review and Comparison of Sand, Permanent Mould and Investment Foundries C.J. Reinhardt	133

High Quality Non-Ferrous Die Castings Dependence on Die Design – A Review of the Use of Die Filling and Casting Solidification Simulation Results for Successful, Effective and Practical Die Designs	
C.J. Reinhardt, M. Murray and I. Bohlken	143
Operational Cost Analysis of a Typical South African High Pressure Die-Casting Business	
F. Pereira	152
Fundamental Differences between Magnesium and Alkali Metal Electrowinning	
D.S. van Vuuren and E. Swanepoel	160
Mechanical Properties and Microstructures of Nano SiC Reinforced ZE10 Composites Prepared with Ultrasonic Vibration	
J.F. Song, H. Dieringa, Y.D. Huang, W.M. Gan, K.U. Kainer and N. Hort	169
Microstructure and Compression Creep Strength of the Newly Developed Magnesium Alloy DieMag422	
H. Dieringa, N. Hort and K.U. Kainer	177

Chapter 3: Light Metals: Titanium

Challenges Experienced in Scaling-Up the CSIR-Ti Process	
S.J. Oosthuizen, J.J. Swanepoel and D.S. van Vuuren	187
Wall Heat Transfer Coefficient in a Molten Salt Bubble Column: Testing the Experimental Setup	
P.J. Skosana, D.S. van Vuuren and M.D. Heydenrych	195
A Study of Solvent Debinding Variables on Ti6Al4V Green Bodies	
M. Seerane, H. Chikwanda, W. Focke and R. Machaka	204
Thermo-Gravimetric Analysis and Debinding Study of Powder Injection Moulded Titanium Alloy	
C.T.C. Crombie and D.C. Blaine	210
Characterisation of Titanium Powder Flow, Shear and Bulk Properties Using the FT4 Powder Rheometer	
S. Chikosha, L.M. Mahlatji and H.K. Chikwanda	218
Influence of Powder Particle Size Distribution on the Properties of Press-and-Sintered Titanium and Ti-6Al-4V Preforms	
H.L. Bosman and D.C. Blaine	225
Process Models for Press-and-Sinter Titanium	
D.C. Blaine, H.L. Bosman and H.H. Laubscher	231
Preparation of Titanium Alloy Rods by Powder Compact Extrusion	
F. Yang, B. Gabbitas, A. Mukhtar and W. Downing	241
Fatigue and Fracture Toughness of Ti-6Al-4V Titanium Alloy Manufactured by Selective Laser Melting	
N.M. Dhansay, R. Tait and T. Becker	248
Establishing the Optimal Process Parameters for the Laser Sintering of Ti64 for Layer Thicknesses of 15 μm and 30 μm and Validation of a Melt Pool Simulation Model	
J. Els, M. Truscott, K. van der Walt and G. Booysen	254
Microstructure and Dry Sliding Wear Property of Laser Clad Ti-6Al-4V under Different Counterface Materials	
B.A. Obadele, P.A. Olubambi and S. Pityana	259
Submicron Grain Size Formation in Thermohydrogenated and Deformed Ti-6Al-4V: The Effect of Processing Route on the Degree of Grain Refinement	
V.N. Vilane, R.D. Knutsen and J.E. Westraadt	266
Hot Deformation Behavior of Ti-6Al-4V Alloy with a Transitional Microstructure in the Isothermal Hot Compression	
Y. Xu, X.J. Yang, X.X. Jiang, Y. He and D.N. Du	273
Friction Hydro Pillar Riveting – Alternative Joining Technique for 3.17mm Ti-6Al-4V Sheet	
D.G. Hattingh and D.S. Tsikayi	280
Influence of Process Heat Input on Static and Dynamic Properties of Friction Stir Welded 3mm Ti6Al4V Alloy	
P.M. Mashinini, D.G. Hattingh and H. Lombard	287

Investigating the High Temperature Oxidation Behavior of TiAl-Based Alloys with Nickel and Ruthenium Additions	
H.C. Mantyi, L.A. Cornish, L.H. Chown and I.A. Mwamba	294
Interaction between Ytria Fully Stabilized Zirconia or Ytria-Zirconia Blended Face-Coat with Ti6Al4V during Investment Casting	
K. Mutombo, C. Kgomo and P. Rossouw	302
Alpha Case Characterization of Hot Rolled Titanium	
F. Conradie, N. Treurnicht and N. Sacks	311
Chatter Investigation in Titanium Milling	
J.C. Fwamba, L.C. Tshabalala, C.P. Ntuli and I. Tlhabadira	318

Chapter 4: Ferrous & Base Metals

Austenite Grain Growth Kinetics in a Low C-Mn Steel and a Ti-Nb-V Microalloyed Steel	
K.A. Annan, C.W. Siyasiya, W.E. Stumpf, K.M. Banks and A.S. Tuling	327
Influence of Cooling Path on the Dynamic Transformation of Austenite-to-Ferrite in Low Carbon Manganese Steels	
J.C. Oguh, C. Siyasiya and W.E. Stumpf	333
The Influence of Initial Grain Size and Strain Sequence of Slab Hot Rolling on the Austenite Evolution of Peritectic Microalloyed Plate Steels	
R. Maubane, K.M. Banks, W. Stumpf, C. Siyasiya and A. Tuling	339
Development of VC-Ni Eutectic Alloys for Wear Resistance	
O.A. Apata, T.N. Muobeleni, A.A. Fabuyide, E.N. Ogunmuyiwa, G.O. Rading, P.K. Jain, M.J. Witcomb and L.A. Cornish	347

Chapter 5: Precious Metals

Preparation of Pt-Promoted Co/SiO₂ Catalysts for CO Hydrogenation by Strong Electrostatic Adsorption (SEA)	
M. de Beer, M. Claeys and E. van Steen	357
Pt/Au Alloys as Reduction Promoters for Co/TiO₂ Fischer-Tropsch Catalysts	
A. Kunene, M. Claeys and E. van Steen	365
Thermal Properties of Amorphous TiPt Alloy Produced by Mechanical Alloying	
M.L. Mahlatji, S. Chikosha, H.K. Chikwanda, W.E. Stumpf and C.W. Siyasiya	372
Temperature Dependence and Martensitic Transformation of Ti₅₀Pt₅₀ Shape Memory Alloys	
M.P. Mashamaite, H. Chauke, R. Mahlangu and P.E. Ngoepe	379
Martensitic Transformation Behaviour of Ti₅₀Pt_{50-x}Co_x Shape Memory Alloys	
R. Mahlangu, H. Chauke and P.E. Ngoepe	385

Chapter 6: Nuclear Materials

Development of an Affordable GD-OES Support Matrix for Analysis of Non-Conducting Zirconium Powders	
S.J. Lötter, W. Purcell and J.T. Nel	393
Sublimation Kinetics of Zirconium Tetrafluoride	
C.J. Pretorius, A.D. Pienaar, P.L. Crouse and H.F. Niemand	398
Molecular Modelling of the Hydrolysis of Tantalum and Niobium Pentafluoride	
M.J. Ungerer, D.J. van der Westhuizen, H.M. Krieg and C.G.C.E. van Sittert	406
Redetermination of the Niobium(V) Precursor, [NbCl₅(NCCH₃)]	
L. Herbst, H.G. Visser and A. Roodt	412
Tantalite Beneficiation through Sequential Separation of Radioactive Elements, Iron and Titanium by Magnetic Separation and Acid Leaching	
M. Nete, W. Purcell and J.T. Nel	419
The Coordination of Novel, Hard Ligand Systems to Tantalum(V) and Niobium(V) Metal Centres	
R. Koen, A. Roodt and H. Visser	426

The Time Dependent Solvent Extraction of Ta and Nb	
L. de Beer, M.J. Ungerer, D.J. van der Westhuizen and H.M. Krieg	433
Fluorination of Rare Earth, Thorium and Uranium Oxides and Phosphates from Monazite: A Theoretical Approach	
D. Kemp and A.C. Cilliers	439