

# **Conference of the South African Advanced Materials Initiative (CoSAAMI 2019)**

IOP Conference Series: Materials Science and Engineering  
Volume 655

Vanderbijlpark, South Africa  
22 - 25 October 2019

ISBN: 978-1-7138-0912-8  
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.**

This work is licensed under a Creative Commons Attribution 3.0 International Licence.  
Licence details: <http://creativecommons.org/licenses/by/3.0/>.

No changes have been made to the content of these proceedings. There may be changes to pagination and minor adjustments for aesthetics.

Printed with permission by Curran Associates, Inc. (2020)

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](mailto: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](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

# TABLE OF CONTENTS

## ADVANCED MANUFACTURING

<b>THE EFFECT OF CAST STRUCTURES ON TEXTURE AND MECHANICAL PROPERTIES OF AISI 433 FERRITIC STAINLESS STEEL</b> .....	1
<i>M Maumela, W E Stumpf, C W Siyasiya</i>	
<b>EFFECT OF THE QUENCH TEMPERATURE ON THE MECHANICAL PROPERTIES OF A MEDIUM C MN HIGH SI STEEL DURING Q&amp;P HEAT TREATMENT PROCESS</b> .....	7
<i>V Kurup, C W Siyasiya, R J Mostert</i>	
<b>MAJOR DETERMINANT OF SERVICE LIFE IN MAGNESIA-GRAPHITE SLAGLINE REFRACTORY LINING IN SECONDARY STEELMAKING LADLE FURNACE</b> .....	18
<i>I O Otunniyi, Z V Theko, B L E Mokoena, B Maramba</i>	
<b>EFFECT OF INTERCRITICAL ANNEALING OF NORMALISED NB-TI-V MICROALLOYED PLATE STEEL ON MICROSTRUCTURAL EVOLUTION</b> .....	28
<i>PI Kambilinyi, CW Siyasiya, KM Banks, RJ Mostert</i>	
<b>THE EFFECT OF SOAKING AND TEMPERING TEMPERATURES ON HIGH VANADIUM ALLOYS FOR GRINDING MEDIA</b> .....	37
<i>AD Mabeba, CW Siyasiya</i>	

## CORROSION

<b>STUDYING THE EFFECT OF SURFACE CONDITIONING ON THE CORROSION PERFORMANCE OF TITANIUM DENTAL IMPLANTS</b> .....	44
<i>N D E Masia, M Smit, A I Mwamba, J S Moema</i>	
<b>DEVELOPMENT OF LINING MATERIALS FOR REACTOR VESSEL USED IN THE CSIR TITANIUM PROCESS</b> .....	56
<i>M P Sehoana, S Fazluddin</i>	

## MODELLING-SIMULATION

<b>DEVELOPMENT OF A MATHEMATICAL EQUATION DESCRIBING THE STRAIN HARDENING BEHAVIOUR OF METASTABLE AISI 301 AUSTENITIC STAINLESS STEEL</b> .....	63
<i>T W Mukarati, R J Mostert, C W Siyasiya</i>	

## ENGINEERING DESIGN

<b>INFLUENCE OF IMPELLER DIAMETER ON THE PERFORMANCE OF CENTRIFUGAL PUMPS.</b> .....	70
<i>M E Matlakala, D V V Kallon, K E Mogapi, I M Mabelane, D M Makgopa</i>	
<b>RELATIONSHIP BETWEEN TOOL TILT ANGLE, SHOULDER PLUNGE DEPTH AND PROCESS ENERGY INPUT FOR PIN-LESS FRICTION STIR WELDED THIN TI-6AL-4V SHEETS</b> .....	80
<i>A B Gili, D G Hattingh, D Bernard</i>	

## SMART MATERIALS

<b>THE EFFECTS OF RU, CU, ZR AND HF ON MECHANICAL PROPERTIES IN TI-PT HIGH TEMPERATURE SHAPE MEMORY ALLOYS</b> .....	90
<i>M P Mashamaite, H R Chauke, P E Ngoepe</i>	

## ADVANCED ALLOYS

<b>CARBIDE-FREE BAINITIC STEELS FOR RAIL WHEEL APPLICATIONS</b> .....	98
<i>A Kapito, R J Mostert, W E Stumpf, C W Siyasiya</i>	
<b>EBSD CHARACTERISATION OF THE B2 ORIENTATION IN <math>\gamma</math>-TiAL BASED ALLOY</b> .....	111
<i>M N Mathabathe, A S Bolokang, G Govender, C W Siyasiya, R J Mostert</i>	
<b>MICROSTRUCTURE CHARACTERISATION AND MICROHARDNESS OF P92 STEEL HEAT TREATED AT THE TRANSFORMATION TEMPERATURES</b> .....	117
<i>J Obiko, L H Chown, D J Whitefield</i>	
<b>EFFECTS OF MO CONTENT ON THE MICROSTRUCTURAL AND MECHANICAL PROPERTIES OF AS-CAST Ti-MO ALLOYS</b> .....	128
<i>N Moshokoa, L Raganya, B Obadele, P Olubambi, R Machaka</i>	

## ADDITIVE MANUFACTURING

<b>SIC AND AL SURFACE CLADDING OF Ti-6Al-4V FOR IMPROVED WEAR PROPERTIES – THE BINARY ADVANTAGE</b> .....	136
<i>U O Okoli, I O Otunniyi, I D Adebisi</i>	
<b>INFLUENCE OF SINTERING TEMPERATURE ON DENSIFICATION, MICROSTRUCTURE AND MECHANICAL PROPERTIES OF Ti-6Ni ALLOY DEVELOPED VIA SPARK PLASMA SINTERING</b> .....	146
<i>A L Rominiyi, M B Shongwe, N B Maledi, S O Jeje, B J Babalola, P F Lepele</i>	
<b>EFFECT OF TEMPERATURE ON DENSIFICATION, MICROSTRUCTURAL EVOLUTION AND MECHANICAL PROPERTIES OF Ti-5Al-1Mo DEVELOPED VIA SPARK PLASMA SINTERING</b> .....	153
<i>S O Jeje, M B Shongwe, N Maledi, A L Rominiyi, B J Babalola, P F Lepele</i>	
<b>MORPHOLOGICAL CHARACTERIZATION OF RECYCLED POWDER AND MICROSTRUCTURES OF Ti-6Al-4V COMPONENTS SYNTHESIZED BY LENS ADDITIVE MANUFACTURING</b> .....	160
<i>P N Sibisi, A P I Popoola, N K K Arthur, S L Pityana, O M Popoola</i>	
<b>EFFECT OF PARTICLE SIZE DISTRIBUTION ON GREEN PROPERTIES AND SINTERING OF Ti-6Al-4V</b> .....	167
<i>K Ramabulana, M Tambani, C Machio, M E Makhatha</i>	
<b>BIOCOMPATIBILITY STUDY OF Ti-BASED ALLOYS FABRICATED BY SPARK PLASMA SINTERING</b> .....	175
<i>M R Mahundla, W R Matizamhuka, R Machaka, A Yamamoto, M B Shongwe</i>	
<b>DEVELOPMENT OF A BIOCOMPATIBLE Ti-Nb ALLOY FOR ORTHOPAEDIC APPLICATIONS</b> .....	183
<i>L Fikeni, K A Annan, M Seerane, K Mutombo, R Machaka</i>	
<b>TENSILE PROPERTIES AND MICROSTRUCTURAL CHARACTERIZATION OF ADDITIVE MANUFACTURED, INVESTMENT CAST AND WROUGHT Ti6Al4V ALLOY</b> .....	191
<i>K Beyl, K Mutombo, C P Kloppers</i>	
<b>THE EFFECT OF TERNARY ALLOYING WITH VANADIUM ON Ti-Pt SHAPE MEMORY ALLOYS</b> .....	202
<i>P Daswa, S Chikosha, M L Mahlatji, C W Siyasiya</i>	
<b>THE MICROSTRUCTURAL AND MECHANICAL CHARACTERIZATION OF THE <math>\beta</math>-TYPE Ti-11.1Mo-10.8Nb ALLOY FOR BIOMEDICAL APPLICATIONS</b> .....	211
<i>M L Raganya, N M Moshokoa, B Obadele, P A Olubambi, R Machaka</i>	
<b>EFFECT OF POWDER BED PREHEATING ON DISTORTION AND MECHANICAL PROPERTIES IN HIGH SPEED SELECTIVE LASER MELTING</b> .....	219
<i>L P Motibane, L C Tshabalala, N R Mathe, S Hoosain, R D Knutsen</i>	
<b>INFLUENCE OF STRESS RELIEVING THERMAL CYCLES ON AISI10MG SPECIMENS PRODUCED BY SELECTIVE LASER MELTING</b> .....	225
<i>B J Mfusi, N R Mathe, P A I Popoola, L C Tshabalala</i>	
<b>PREPARATION AND MICROSTRUCTURAL CHARACTERIZATION OF THE 60Al-40V MASTER ALLOY</b> .....	232
<i>T O Mapoli, K A Annan, C W Siyasiya, Kalenda Mutombo</i>	
<b>INVESTIGATION OF GRAPHENE-BASED NANOCOMPOSITE FOR HYDROGEN STORAGE</b> .....	240
<i>S J Baloyi, A Ngqalakezi, D Nkazi, T A Ntho</i>	

<b>INFLUENCE OF HEAT TREATMENT ON MICROSTRUCTURE AND MECHANICAL PROPERTIES OF NI-FE-CO TERNARY ALLOY PREPARED VIA SPARK PLASMA SINTERING</b> .....	248
<i>I M C Bopape, M B Shongwe, E N Ogunmuyiwa, A L Rominiyi, S O Jeje</i>	
<b>EFFECT OF NICKEL POWDER PARTICLE SIZE ON THE MICROSTRUCTURE AND THERMOPHYSICAL PROPERTIES OF SPARK PLASMA SINTERED NICRCOALTIW-TA SUPERALLOY</b> .....	255
<i>O F Ogunbiyi, T Jamiru, E R Sadiku, O T Adesina, S A Salifu, L W Benke</i>	
<b>INFLUENCE OF SPARK PLASMA SINTERING TEMPERATURE ON THE DENSIFICATION AND MICRO-HARDNESS BEHAVIOUR OF NI-CR-AL ALLOY</b> .....	264
<i>B J Babalola, M B Shongwe, S O Jeje, A L Rominiyi, O O Ayodele, P A Olubambi</i>	
<b>METAL INJECTION MOULDING OF 17-4PH STAINLESS STEEL: EFFECTS OF POROSITY ON THE MECHANICAL PROPERTIES OF THE SINTERED PRODUCTS</b> .....	271
<i>M N Seerane, R Machaka</i>	

## **COMPOSITES**

<b>FRETTING BIOCORROSION BEHAVIOUR OF TITANIUM-ZIRCONIA COMPOSITES IN FOETAL BOVINE SERUM</b> .....	277
<i>L Semetse, B A Obadele, L Raganya, J Geringer, P A Olubambi</i>	
<b>PROSPECTS OF GRAPHITE - POLYPROPYLENE/EPOXY BLEND COMPOSITE FOR HIGH PERFORMANCE BIPOLAR PLATE IN POLYMER ELECTROLYTE MEMBRANE FUEL CELL</b> .....	287
<i>O A Alo, I O Otunniyi, HCVZ Pienaar</i>	
<b>DEVELOPMENT AND CHARACTERIZATION OF POROUS TI-SN-SIC COMPOSITE INTENDED FOR BIOMEDICAL APPLICATION</b> .....	296
<i>C R Mathebula, W Matizambuka, A S Bolokang</i>	
<b>INFLUENCE OF WARM TEMPERATURE (0.3-0.5TM) UNIAXIAL COMPRESSION ON THE DISTRIBUTION OF REINFORCING PARTICLES IN A 2124-AL/10%SiC MMC</b> .....	304
<i>Z Gxowa-Penxa, L H Chown, G Govender</i>	
<b>PREPARATION AND CHARACTERIZATION OF GLASS-CERAMIC COMPOSITES FROM SOUTH AFRICAN COAL FLY ASH</b> .....	312
<i>A Modiga, N Sosibo, N Singh</i>	
<b>DEVELOPMENT OF MGAL2O4 GRAIN REFINER IN AL IN-SITU COMPOSITE THROUGH H3BO3 ADDITION</b> .....	321
<i>P Chandramohan, P A Olubambi, R Raghu, B A Obadele</i>	

## **NUCLEAR MATERIALS**

<b>PLASMA DISSOCIATION OF MONAZITE</b> .....	330
<i>H Bissett, M M Makhofane, R van der Merwe, S J Lotter</i>	
<b>THE EFFECT OF MOLAR RATIO AND FLOW VELOCITY ON THE SURFACE AREA REQUIRED FOR PERTRACTION OF A ZR/HF MIXTURE</b> .....	339
<i>D Malan, DJ van der Westhuizen, HWJP Neomagus, HM Krieg</i>	

## **COMPUTATIONAL MATERIALS SCIENCE**

<b>DENSITY FUNCTIONAL THEORY STUDY OF TIPD ALLOYING WITH OS AS POTENTIAL HIGH TEMPERATURE SHAPE MEMORY ALLOYS</b> .....	345
<i>R G Diale, R Modiba, P E Ngoepe, H R Chauke</i>	
<b>FIRST PRINCIPLE STUDY OF HF MOLECULE ADSORPTION ON TiO<sub>2</sub> (110) SURFACE</b> .....	352
<i>D M Tshwane, R Modiba, H R Chauke, G Govender, P E Ngoepe</i>	
<b>FIRST-PRINCIPLES STUDIES ON THE STRUCTURAL, ELECTRONIC AND MECHANICAL PROPERTIES OF L10 AND L12 FeXPT1-X ALLOYS</b> .....	361
<i>N L Lethole, H R Chauke, P E Ngoepe</i>	
<b>SURFACE MORPHOLOGY CHARACTERISATION FOR PARTS PRODUCED BY THE HIGH SPEED SELECTIVE LASER MELTING</b> .....	368
<i>M Shange, I Yadroitsava, S Pityana, I Yadroitsev, D Bester</i>	

<b>THERMO-MECHANICAL SIMULATION OF STEAM TURBINE BLADE WITH SPARK PLASMA SINTERING FABRICATED INCONEL 738LC SUPERALLOY PROPERTIES .....</b>	<b>376</b>
<i>O F Ogunbiyi, S A Salifu, T Jamiru, E R Sadiku, O T Adesina</i>	

## **CATALYSIS**

<b>EXPLORING THE POTENTIAL OF N-ACYLATED CHITOSAN FOR THE REMOVAL OF TOXIC POLLUTANTS FROM WASTEWATER .....</b>	<b>382</b>
<i>S Naidoo, N Nomadolo, W M R Matshe, Z Cele, M Balogun</i>	
<b>PILLARED INTERLAYERED CLAYS AS CATALYST FOR WASTEWATER TREATMENT: COST-EFFECTIVE AND SUSTAINABLE MATERIALS .....</b>	<b>392</b>
<i>S J Baloyi, T W P Seadira, T A Ntho</i>	
<b>SOLAR PHOTOCATALYTIC HYDROGEN PRODUCTION FROM GLYCEROL REFORMING USING TERNARY CU/THS/GRAPHENE .....</b>	<b>400</b>
<i>T W P Seadira, S J Baloyi, C M Masuku, M S Scurrrell</i>	
<b>KINETIC STUDY OF PHENOL OXIDATION IN A TRICKLE BED REACTOR OVER AL/ZR- PILLARED CLAY CATALYST .....</b>	<b>411</b>
<i>T J Makatsa, S J Baloyi, T A Ntho, C M Masuku</i>	
<b>Author Index</b>	