



Volume 128, 10 May 2014

ISSN 0013-4686

Journal of the International Society of Electrochemistry

Electrochimica Acta

Special Volume:

ADVANCES IN ELECTROCHEMICAL MATERIALS SCIENCE AND MANUFACTURING

Selection of papers from the 13th ISE Topical Meeting 07-10 April 2013,
Pretoria, South Africa

GUEST EDITOR:

Kenneth I. Ozoemena

EDITORIAL CO-ORDINATION:

S. Trasatti

Available online at www.sciencedirect.com

ScienceDirect



CONTENTS

VOLUME 128

2014

Special Volume

ADVANCES IN ELECTROCHEMICAL MATERIALS SCIENCE AND MANUFACTURING

KENNETH I. OZOEMENA

FENGJIE XIA, MU PAN, SHICHUN MU,
RICHARD MALPASS-EVANS, MARIOLINO CARTA,
NEIL B. McKEOWN, GARY A. ATTARD, ASHLEY BREW,
DAVID J. MORGAN and FRANK MARKEN

EDWARD M. REGAN, ANDREW J. HALLETT,
L.C. CALEB WONG, IBRAHIM Q. SAEED,
EMILY E. LANGDON-JONES, NIKLAAS J. BUURMA,
SIMON J.A. POPE and PEDRO ESTRELA

NADA F. ATTA, SHIMAA M. ALI, EKRAM H. EL-ADS and
A. GALAL

F.M.A. LINO, L.Z. DE SÁ, I.M.S. TORRES, M.L. ROCHA,
T.C.P. DINIS, P.C. GHEDINI, V.S. SOMERSET and E.S. GIL

STEPHEN NYONI, TAWANDA MUGADZA and
TEBELLO NYOKONG

JAN KRUID, RONEN FOGEL and JANICE LIMSON

THABILE NDLOVU, BHEKIE B. MAMBA,
SRINIVASAN SAMPATH, RUI W. KRAUSE and
OMOTAYO A. AROTIBA

ABDULKADIR LEVENT, AHMET ALTUN, YAVUZ YARDIM and
ZÜHRE ŞENTÜRK

ELAINE SPAIN, EOIN BRENNAN, TIA E. KEYES and
ROBERT J. FORSTER

M. LIGAJ, M. TICHONIUK, D. GWIAZDOWSKA and
M. FILIPIAK

V. LATES, A. FALCH, A. JORDAAN, R. PEACH and
R.J. KRIEK

JOHANNA RIEDEL, MONIKA BERTHOLD and ULRICH GUTH
EWA BRANCEWICZ, EMILIA GRĄDZKA, ANNA BASA and
KRZYSZTOF WINKLER

SANDRO CARRARA, CAMILLA BAI-RSSI, CRISTINA BOERO
and GIOVANNI DE MICHELI

ARELY CÁRDENAS, MARTÍN GÓMEZ and
CARLOS FRONTANA

BONGIWE SILWANA, CHARLTON VAN DER HORST,
EMMANUEL IWUOHA and VERNON SOMERSET

CHRISTOPHER E. SUNDAY, MAWETHU BILIBANA,
SINAZO QAKALA, OLUWAKEMI TOVIDE,
KERILENG M. MOLAPO, GERTRUDE FOMO,
CHINWE O. IKPO, TESFAYE WARYO, GCINEKA MBAMBISA,

BULELWA MPUSHE, AVRIL WILLIAMS,

PRISCILLA G.L. BAKER, SIBULELO VILAKAZI,

ROBERT TSHIKHUDO and EMMANUEL I. IWUOHA

OLUWAKEMI TOVIDE, NAZEM JAHEED,

NURALI MOHAMED, EZO NXUSANI,

CHRISTOPHER E. SUNDAY, ABEBAW TSEGAYE,

RACHEL F. AJAYI, NJAGI NJOMO, HLAMULU MAKELANE,

MAWETHU BILIBANA, PRISCILLA G. BAKER,

AVRIL WILLIAMS, SIBULELO VILAKAZI,

ROBERT TSHIKHUDO and EMMANUEL I. IWUOHA

1 Foreword

Electrocatalysis and Electrochemical Sensing

3 Polymers of intrinsic microporosity in electrocatalysis: Novel pore rigidity effects and lamella palladium growth

10 A novel cobalt complex for enhancing amperometric and impedimetric DNA detection

16 Nano-perovskite carbon paste composite electrode for the simultaneous determination of dopamine, ascorbic acid and uric acid

25 Voltammetric and spectrometric determination of antioxidant capacity of selected wines

32 Improved L-cysteine electrocatalysis through a sequential drop dry technique using multi-walled carbon nanotubes and cobalt tetraaminophthalocyanine conjugates

41 Voltammetric investigation of complex growth media at a bare glassy carbon electrode: A case study of oxytetracycline

48 Voltammetric detection of arsenic on a bismuth modified exfoliated graphite electrode

54 Sensitive voltammetric determination of testosterone in pharmaceuticals and human urine using a glassy carbon electrode in the presence of cationic surfactant

61 Dual function metal nanoparticles: Electrocatalysis and DNA capture

67 Electrochemical DNA biosensor for the detection of pathogenic bacteria *Aeromonas hydrophila*

75 An electrochemical study of carbon dioxide electroreduction on gold-based nanoparticle catalysts

85 Electrochemical determination of dissolved nitrogen-containing explosives

91 Chemical synthesis and characterization of the C₆₀-Pd polymer spherical nanoparticles

102 Do Carbon Nanotubes contribute to Electrochemical Biosensing?

113 Development of an Electrochemical Cupric Reducing Antioxidant Capacity Method (CUPRAC) for Antioxidant Analysis

119 Screen-printed carbon electrodes modified with a bismuth film for stripping voltammetric analysis of platinum group metals in environmental samples

128 Modulation of the matrix effect of nafion on tris(bipyridine) ruthenium(II) electrochemical probes by functionalisation with 4-nitrophenylazo graphene-gold nanocomposite

138 Graphenated polyaniline-doped tungsten oxide nanocomposite sensor for real time determination of phenanthrene

RACHEL F. AJAYI, UNATHI SIDWABA, USISIPIO FELINI, SAMANTHA F. DOUMAN, OLUWAKEMI TOVIDE, SUBELIA BOTHA, PRISCILLA BAKER, XOLILE G. FUKU, SARA HAMID, TESFAYE T. WARYO, SIBULELO VILAKAZI, ROBERT TSHIKUDO and EMMANUEL I. IWUOHA	149	Chemically amplified cytochrome P450-2E1 drug metabolism nanobiosensor for rifampicin anti-tuberculosis drug
Electrochemical Energy Storage and Conversion Systems		
BIN SHAO and IZUMI TANIGUCHI	156	Synthesis of $\text{Li}_2\text{MnSiO}_4/\text{C}$ nanocomposites for lithium battery cathode employing sucrose as carbon source
DOMINIC BRESSER, FRANZiska MUELLER, DANIEL BUCHHOLZ, ELIE PAILLARD and STEFANO PASSERINI	163	Embedding tin nanoparticles in micron-sized disordered carbon for lithium- and sodium-ion anodes
MESFIN A. KEBEDE, NIKIWE KUNJUZWA, CHARL J. JAFTA, MKHULU K. MATHE and KENNETH I. OZOEMENA	172	Solution-combustion synthesized nickel-substituted spinel cathode materials ($(\text{LiNi}_{x}\text{Mn}_{2-x}\text{O}_4; 0 \leq x \leq 0.2)$) for lithium ion battery: enhancing energy storage, capacity retention, and lithium ion transport
NATASHA ROSS, EMMANUEL I. IWUOHA, CHINWE O. IKPO, PRISCILLA BAKER, NJAGI NJOMO, STEPHEN N. MAILU, MILUA MASIKINI, NOLUBABALO MATINISE, ABEBAW TSEGAYE, NOLUTHANDO MAYEDWA, TESFAYE WARYO, KENNETH I. OZOEMENA and AVRIL WILLIAMS	178	Amplification of the discharge current density of lithium-ion batteries with spinel phase $\text{Li}(\text{PtAu})_{0.02}\text{Mn}_{1.98}\text{O}_4$ nano-materials
A. SHAHUL HAMEED, M.V. REDDY, B.V.R. CHOWDARI and JAGADESE J. VITTAL	184	Carbon coated $\text{Li}_3\text{V}_2(\text{PO}_4)_3$ from the single-source precursor, $\text{Li}_2(\text{VO})_2(\text{HPO}_4)_2(\text{C}_2\text{O}_4)_2 \cdot 6\text{H}_2\text{O}$ as cathode and anode materials for Lithium ion batteries
M.V. REDDY, THOR WEI JIE, CHARL J. JAFTA, KENNETH I. OZOEMENA, MKHULU K. MATHE, A. SREEKUMARAN NAIR, SOO SOON PENG, M. SOBRI IDRIS, GEETHA BALAKRISHNA, FABIAN I. EZEMA and B.V.R. CHOWDARI	192	Studies on Bare and Mg-doped LiCoO_2 as a cathode material for Lithium ion Batteries
M.V. REDDY, R. JOSE, A. LE VIET, KENNETH I. OZOEMENA, B.V.R. CHOWDARI and S. RAMAKRISHNA	198	Studies on the lithium ion diffusion coefficients of electrospun Nb_2O_5 nanostructures using galvanostatic intermittent titration and electrochemical impedance spectroscopy
E.E. FERC and F. VAN VUUREN	203	Comparative capacity performance and electrochemical impedance spectroscopy of commercial AA alkaline primary cells
KRZYSZTOF FIC, MIKOŁAJ MELLER and ELZBIETA FRACKOWIAK	210	Strategies for enhancing the performance of carbon/carbon supercapacitors in aqueous electrolytes
ASSUMPTA C. NWANYA, CHARL J. JAFTA, PAUL M. EJIKEME, PAULINUS E. UGWUOKE, M.V. REDDY, ROSE U. OSUJI, KENNETH I. OZOEMENA and FABIAN I. EZEMA	218	Electrochromic and electrochemical capacitive properties of tungsten oxide and its polyaniline nanocomposite films obtained by chemical bath deposition method
NJAGI NJOMO, TESFAYE WARYO, MILUA MASIKINI, CHINWE O. IKPO, STEPHEN MAILU, OLUWAKEMI TOVIDE, NATASHA ROSS, AVRIL WILLIAMS, NOLUBABALO MATINISE, CHRISTOPHER E. SUNDAY, NOLUTHANDO MAYEDWA, PRISCILLA G.L. BAKER, KENNETH I. OZOEMENA and EMMANUEL I. IWUOHA	226	Graphenated tantalum(IV) oxide and poly(4-styrene sulphonic acid)-doped polyaniline nanocomposite as cathode material in an electrochemical capacitor
ERIC GAUTHIER and JAY B. BENZIGER	238	Gas management and multiphase flow in direct alcohol fuel cells
PHILIPPE MANDIN, ZINE DERHOUMI, HERVÉ ROUSTAN and WÜTHRICH ROLF	248	Bubble Over-Potential During Two-Phase Alkaline Water Electrolysis
MINORU UMEDA, SAYOKO SHIRONITA, TSUKASA SAKAI, MASAHIRO IDE and HIRONOSUKE IKEDA	259	Ex situ microelectrode study of cathode catalyst degraded by long-term endurance test in polymer electrolyte fuel cell
SAYOKO SHIRONITA, WEIQI ZHANG, TSUKASA SAKAI and MINORU UMEDA	265	Evaluation of reaction selectivity at various Pt/C electrocatalysts using a porous microelectrode in the presence of methanol and oxygen
JUSTUS MASA, ANQI ZHAO, WEI XIA, MARTIN MUHLER and WOLFGANG SCHUHMANN	271	Metal-free catalysts for oxygen reduction in alkaline electrolytes: Influence of the presence of Co, Fe, Mn and Ni inclusions
OMBOSEDE O. FASHEDEMI and KENNETH I. OZOEMENA	279	Comparative electrocatalytic oxidation of ethanol, ethylene glycol and glycerol in alkaline medium at Pd-decorated FeCo@Fe/C core-shell nanocatalysts
PILWON HEO, YANBAI SHEN, KEIJIRO KOJIMA, CHANHO PAK, KYOUNG HWAN CHOI and TAKASHI HIBINO	287	$\text{Fe}_{0.4}\text{Ta}_{0.5}\text{P}_2\text{O}_7$ -based composite membrane for high-temperature, low-humidity proton exchange membrane fuel cells
BRUNO G. POLLET and JONATHAN T.E. GOH	292	The importance of ultrasonic parameters in the preparation of fuel cell catalyst inks

V. BAGLIO, D. SEBASTIÁN, C. D'URSO, A. STASSI, R.S. AMIN, K.M. EL-KHATIB and A.S. ARICÒ	304	Composite anode electrode based on iridium oxide promoter for direct methanol fuel cells
EDITH MSHOPERI, RONEN FOGEL and JANICE LIMSON	311	Application of carbon black and iron phthalocyanine composites in bioelectricity production at a brewery wastewater fed microbial fuel cell
MINLING SHAO, DMITRII A. GUSCHIN, ZAHMA KAWAH, YVONNE BEYL, LEONARD STOICA, ROLAND LUDWIG, WOLFGANG SCHUHMANN and XINGXING CHEN	318	Cellobiose dehydrogenase entrapped within specifically designed Os-complex modified electrodeposition polymers as potential anodes for biofuel cells
LISEBO PHELANE, FRANCIS N. MUYA, HEIDI L. RICHARDS, PRISCILLA G.L. BAKER and EMMANUEL I. IWUOHA	326	Polysulfone Nanocomposite Membranes with improved hydrophilicity
ABASIFREKE EBONG	336	Pathway to low-cost metallization of silicon solar cell through understanding of the silicon metal interface and plating chemistry
LOK-KUN TSUI and GIOVANNI ZANGARI	341	Modification of TiO_2 nanotubes by Cu_2O for photoelectrochemical, photocatalytic, and photovoltaic devices
LADISLAV KAVAN, JUN-HO YUM and MICHAEL GRAETZEL	349	Graphene-based cathodes for liquid-junction dye sensitized solar cells: Electrocatalytic and mass transport effects
S. KÜNZE and D. SCHLETTWEIN	360	Electrochemical and electroless deposition of porous zinc oxide on aluminium
HENRIETTA W. LANGMI, JIANWEI REN, BRIAN NORTH, MKHULU MATHE and DMITRI BESSARABOV	368	Hydrogen Storage in Metal-Organic Frameworks: A Review
Electrodeposition and Applications		
M. VALDES, M. MODIBEDI, M. MATHE, T. HILLIE and M. VAZQUEZ	393	Electrodeposited $\text{Cu}_2\text{ZnSnS}_4$ thin films
LEAH B. SHERIDAN, VERONICA M. YATES, DAVID M. BENSON, JOHN L. STICKNEY and DAVID B. ROBINSON	400	Hydrogen sorption properties of bare and Rh-modified Pd nanofilms grown via surface limited redox replacement reactions
REMSEGIA M. MODIBEDI, MKHULU K. MATHE, RAPELANG G. MOTSOENENG, LINDIWE E. KHOTSENG, KENNETH I. OZOEMENA and ELDAH K. LOUW	406	Electro-deposition of Pd on Carbon paper and Ni foam via surface limited redox-replacement reaction for oxygen reduction reaction
GUILLAUME GOTTI, KATIA FAJERWERG, DAVID EVRARD and PIERRE GROS	412	Electrodeposited gold nanoparticles on glassy carbon: Correlation between nanoparticles characteristics and oxygen reduction kinetics in neutral media
PRzemysław LEDWON, ALINA BRZECZEK, SANDRA PLUCZYK, TOMASZ JAROSZ, WOJCIECH KUZNICK, KRZYSZTOF WALCZAK and MIECZYSŁAW ŁAPKOWSKI	420	Synthesis and electrochemical properties of novel, donor-acceptor pyrrole derivatives with 1,8-naphthalimide units and their polymers
P. DATA, P. PANDER, M. ŁAPKOWSKI, A. SWIST, J. SOŁODUCHO, R.R. REGHU and J.V. GRAZULEVICIUS	430	Unusual properties of electropolymerized 2,7- and 3,6- carbazole derivatives
EUODIA H. HESS, TESFAYE WARYO, OMOWUNMI A. SADIQ, EMMANUEL I. IWUOHA and PRISCILLA G.L. BAKER	439	Constitution of novel polyamic acid/polypyrrole composite films by <i>in-situ</i> electropolymerization
ABD ALMONAM BALEG, NAZEEM JAHED, ANNE L. DJOUMESSI YONKEU, NJAGI NJOMO, GCINEKA MBAMBISA, KERILENG M. MOLAPO, XOLILE G. FUKU, GERTRUDE FOMO, HLAMULO MAKELANE, ABEBAW TSEGAYE, TESFAYE T. WARYO, PRISCILLA BAKER, SIBULELO VILAKAZI, ROBERT TSHIKHUDO and EMMANUEL I. IWUOHA	448	Impedimetry and microscopy of electrosynthetic poly(propylene imine)-co-polypyrrole conducting dendrimeric star copolymers

- I Recent SI
II Future SI