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### Manganese Symposium Contents

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INFACON Nine Contents

JUNE 4 8:00-8:30 OPENING CEREMONY
Welcome to INFACON Nine
Dieter Ksinsik: INFACON Nine Chairman
Welcome from The Ferroalloys Association
Edward J. Kinghorn, Jr.: TFA President
Welcome from Quebec
Quebec Government Official

JUNE 4 8:30-10:00 PLENARY SESSION
Outlook from the Steel Industry
Duane R. Dunham: Chairman, President and CEO of Bethlehem Steel
Outlook from the Silicones Industry
Gary Anderson: President and CEO of Dow Corning
Manganese Outlook and Symposium Overview
Jose Antonio Rivero: Minera Autlan - Chairman of the International Manganese Institute
Restructure of Chinese Ferroalloy Industry
Zhang Zengchan: Secretary General of the Chinese Ferroalloy Industry Association

JUNE 4 10:30-12:30 PLENARY SESSION
Trends in U.S. Customer Needs for Ferroalloys
Key Developments in the Ferroalloy Markets
Jorn P. De Linde: CRU International
The Internet and Emerging Communication Technologies
Lisa Riceman: Arthur Anderson
The Ferroalloy Industry and Global Climate Change: Risk Minimization and Economic Opportunity
Michael Mondshine, SAIC

JUNE 4 14:00-17:30 BREAKOUT - SIMULATION CONTROL MODELING
Determination of Component Activities in the Cr-Si-C and Cr-Fe-Si-C Melts
K. Kossyrev: Moscow Steel and Alloys Institute, K. Maruchkin and A.S. Alikhanyan: Kurnakov Institute of Inorganic Chemistry, and S.E. Olsen: Norwegian University Science & Technology
DC Arc Furnace Technology Applied to Smelting Applications
Kjell Bergley and Björn Kjellberg: Danieli CentroMet
Flow and Heat Transfer in a Radially Spreading Liquid Metal Jet Related to Casting of Ferroalloys
Harald Haaland: Elkem Shared Services and Jon Arne Bakken: Norwegian University of Science & Technology
Experiences in Operation of Various Electric-Arc Furnaces under Resistance Control
A.L. Moolman, M.S. Rennie, and P. Brereton-Stiles: Mintek
Information Management in the Ferroalloy Business
M.S. Rennie, W.D. Carew, R. Terblanche, A.L. Moolman, and N. Anthony: Mintek
A Thermodynamic Model for Silicon Furnace
X. de la Juganniére, Pechiney Electrométallurgie
Discussion of Ideal Smelting Model of Submerged-Arc Furnace
Li Jingchun: Jilin Ferroalloy Group Co. Ltd.

The Related Practices for the Design for Low Frequency Electric Arc Furnace
Li Zhichao: Xi’an Huaxing: Electric Furnace Co. Ltd.

JUNE 4 14:00-17:30 BREAKOUT - FERROCHROMIUM AND FERRONICKEL
Reduction of Chromium Oxide by Methane-containing Gas
O. Ostrovski and Nathaniel Anacletto: University of New South Wales, Andrew Jacobs: BHP Steel, and Gregory McKenzie: BHP Research

Kinetic Modelling of Chromite Pellet Reduction with Co Gas Under Rising Temperatures from 700 to 1520 Degrees C
Yanping Xiao and Markus Reuter: Delft University of Technology, and Lauri Holappa: Helsinki University of Technology

Kinetic Study on Smelting Reduction of Chromite Ore
Marko Kekkonen and Lauri Holappa: Helsinki University of Technology, and Pekka Niemelä: AvestaPolarit Chrome Oy

Excavation of a 54 MVA HC-Ferrochromium Furnace
Eli Ringdalen and Johan Eilertsen: Elkem Rana As

Status Report on Pyrometallurgical Ferronickel Production
G. Rath, J. Kunze, and R. Degal: SMS-DEMAG AG

Pig-Iron and Ferroalloys Production in Oxygen Reactor
V.A. Grigoryan, A.V. Pavlov, A.E. Semin, and K.L. Kossyrev: Moscow Steel and Alloys Institute

Probe into Decreasing Sulphur Contents in Medium Ferrochromium in Converter Practice
Weng Hongbin and Li Pengyun: Zhengjiang Hengshan Ferroalloy Works

JUNE 5 8:00-10:30 BREAKOUT - FERROMANGANESE AND SILICOMANGANESE #1
Kinetics of the Prereduction of Manganese Ores
Merete Tangstad, Stein Wasbøe and Ragnar Tronstad: Eramet Norway R&D and Michel Sibony: Centre de Recherche de Trappes

Sintering of COMILOG Ore in Moanda
JJ Dailloux: Eramet Comilog Manganese SA; M. Sibony and F. Wasser: CRT

Sintered Manganese Ore and its Use in Ferromanganese Production
Jorma Daavittila, Päivi Oikarinen: Outokumpu Engineering Contractors Oy; and Riku Sarkkinen and Helge Krogerus: Outokumpu Research Oy

Kinetics of Gaseous Reduction of Manganese Ore
Tor Lindstad: SINTEF Materials Technology and Lars-Arne Stalheim: Norwegian University of Science and Technology

Metallothermic Reduction of Tavas Manganese Ore
Onuralp Yücel, Alper Özcan Keskin, and Filiz Cinar Şahin: Istanbul Technical University

High Thermal Electrical Property of Manganese Ore in Production of High Carbon Ferromanganese
Yoshihiro Miyauchi, Masashi Mochida, and Yasunari Fuchi: Nippon Denko Co.

JUNE 5 8:30-10:30 BREAKOUT - SILICON AND FERROSILICON #1
The Worldwide Silicon Market and New Technologies
Javier Bullón Camarasa and Santiago Oller Velasco: Ferroatlántica S.L.

Arc Simulation Model for Three-Phase Electro-metallurgical furnaces
G.A Savvarsdottr, J.A. Bakken, V.G. Sevastyanenko, Liping Gu: Norwegian University of Science and Technology
The SKTEC Electrode – An Adaptable Electrode Design for the Production of Silicon Metal and Ferrosilicon
Rene Boisvert: Bécancour Silicon

Use of Biocarbon in Norwegian Ferroalloy Production
Bodil Monsen and Morten Grønli: SINTEF; Lars Nygaard: FESIL ASA; and Halvard Tveit, ELKEM ASA

JUNE 5 11:00-13:00 BREAKOUT - FERROMANGANESE AND SILICOMANGANESE #2
The Slag Basicity Concept in the HC FeMn Process
S.E. Olsen: Norwegian University of Science & Technology
Effect of Gas Composition on the Carbothermic Reduction of Manganese Ore and Ferromanganese Slag
M. Yastreboff and Oleg Ostrovski: University of New South Wales; and S. Ganguly: Tasmanian Electrometallurgical Company
Factors Affecting Carbon Consumption in the Production of High Carbon Ferromanganese
K.N. Swamy and D.G.C. Robertson: University of Missouri-Rolla; and P. Calvert and D. Kozak: Eramet Marietta, Inc.
Kinetic Modelling of MnO Reduction from Manganese Ore
Oleg Ostrovski and M. Yastreboff: University of New South Wales; S.E. Olsen: Norwegian University of Science and Technology; and M. Tangstad: Eramet Norway

JUNE 5 11:00-13:00 BREAKOUT - SILICON AND FERROSILICON #2
Modeling of the Silicon Process as a DAE System
Martin G. Ruszkowski, and Lorenz T. Biegler: Department of Chemical Engineering; Tor Lindstad: SINTEF Materials Technology; and B. Erik Ydstie
Oxidation of Liquid Silicon-Reaction Mechanisms and Kinetics
Kjetil Hildal and Johan Kr. Tuset: Norwegian University of Science and Technology
Stream Explosions of Single Drops of Molten Silicon-Rich Alloys
Selectivity and Reactivity of the Trichlorosilane Process
Geir J. Andersen and Harald A. Øye: Norwegian University of Science & Technology, NTNU; Jan-Otto Hoel: SINTEF Applied Chemistry; and Harry Rong: Elkem ASA

JUNE 5 14:30-17:30 BREAKOUT - FERROMANGANESE AND SILICOMANGANESE #3
Mineralogical and Thermodynamic Investigation of CLU Converter Lining Failures in Commercial Production of Medium Carbon FeMn
Lloyd R. Nelson: Tubatse Ferrochrome, Samancor Chrome; PHF Bouwer: Transalloys; and Natalie B. Buenk: Ferroveld
The Binary Diagrams within the System Fe-Mn-C-O, and the Thermal Properties of Elemental Manganese
J. Fenstad and J.K. Tuset: Norwegian University of Science & Technology

The Processing of Jigged Ferromanganese Fines in a DC Arc Furnace
K. Bisaka and G. M. Denton: MINTEK; and J.A.L. Parker: Titaco
SiMn Production in a 150 KVA Pilot Scale Furnace
M. Tangstad, B. Heiland, and R. Trondstad: Eramet Norway R&D; and S.E. Olsen: NTNU
The Production of Purified Mn-Si Alloy
Ye Yunfeng and Dong Ying: Jilin Ferroalloys Corp.
JUNE 6 9:30-10:30 BREAKOUT - GLOBAL UPDATES
The Present Situation of Ferroalloy Production and Consumption in Turkey 544
Süheyla Aydin, Onuralp Yücel, Cüneyt Arslan, and Akin Koksal: Istanbul Technical University
A Survey of the Iranian Ferroalloy Industry 550
D. Sargheini: The Ministry of Mines and Metals; S Heshmati-Manesh and A. Ataie: Tehran University

JUNE 6 11:00-13:00 PLENARY SESSION
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Aluminum-based Solutions for the Automotive Industry 558
Don Macmillan, President of Alcan Automotive Products
The Future Role of Ferroalloys in Iron and Steel 562
Øystein Grong: NTNU; Pär Jönsson: Department of Metallurgy, KTH; and Ole-Svein Klevan: Elkem ASA, c/o Elkem Thamshavn
Future Demands on Ferroalloys from the Customers in the Steel Industry 573
Pär Jönsson and Thobias Sjöqvist: Div. of Metallurgy, KTH; and Øystein Grong: Dept. of Materials Technology and Electrochemistry, NTNU
The Effect of Ferromanganese Cleanness on Inclusions in Steel
Thobias Sjöqvist and Pär Jönsson: Royal Institute of Technology; and Halvard Berg: Eramet Norway

Oxidation Studies During Decarburization of FeMn
P. J. Bhonde and R.D. Angal: Indian Institute of Technology

JUNE 5 14:30-17:00 BREAKOUT - ENVIRONMENT

Mercury Removal from Off-gases at Tinfos Manganese Plant, Øye Smelteverk
Matts Bruno and Dag Haaland: Tinfos Jernverk AS; and Thomas Thomassen: MILTEC AS

Bacterial Reduction of Hexavalent Cr: A Viable Environmental Solution to the Treatment of Effluent from a FeCr Smelter
Willem A. Gericke: Billiton Centre for Pyrometallurgy

The Environmental Challenge: the Approach Adopted for the Manufacture of Chromium Metal and FerroTitanium
L. Ranson: London & Scandinavian Metallurgical Co Limited

EuroAlliages Research Project for Environmental Hazard-Evaluation of Ferroalloys and Slags

Study on Magnesia Ramming Bottom Lining in Ferroalloy Refining Furnace and Its Application
Wang Shouyuan: Jilin Ferroalloys Group Co. Ltd.

Improving Profitability by Analyzing Ferroalloy Furnace Lining Performance to Improve Lifetime
Reinoud J. van Laar, Albert J. Dzermejko, and John M. Risi: Danieli Corus Technical Services; Hugo Höfl: Samancor Chrome; and Jacques Malan

Use of Soderberg Electrode Paste in Briquetes
José Paulo M. Amaro, M.Met: Technical Services Carboindustrial S.A.; Geraldo A. Messias Lima: Ferroligas Maringá; and Euclides Jose' Lourenco and Jose' Alcestes Belmonte: Carboindustrial S.A.

Operation of Soderberg Electrodes Methods to Avoid and Solve Electrode Failures
Gunnar Andersen, Reidar Innvar and Bjørnar Larsen: Elkem Carbon

Application of Magnesite Ramming Mix in Production of Ferroalloy

Impact of Electrode Paste on Soderberg Electrode Performance
P.M. Wilkinson, Dr. S. Ganguly, P.A. Williams, and L.J. Jensen: Tasmanian Electro Metallurgical Co. Pty. Ltd.
Manganese Symposium Contents

JUNE 4 8:00-8:30 OPENING CEREMONY
Welcome to INFACON Nine
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Outlook from the Silicones Industry
Gary Anderson: President and CEO of Dow Coming
Manganese Outlook and Symposium Overview
Jose Antonio Rivero: Minera Autlan: - Chairman of the International Manganese Institute
Chinese Ferroalloy Industry into the New Century
Zhang Zengchan: Secretary General of the Chinese Ferroalloy Industry Association

JUNE 4 10:30-12:30 SESSION 1: OPENING SESSION
Open Issues from 15th International Conference on Manganese
Michael Aschner: Manganese Symposium Technical Chairman
The Status of MMT at the US EPA
J. Michael Davis: US Environmental Protection Agency
Combustion Products of the MMT Fuel Additive
Joseph W. Roos, Donald R. Lynam, Isaac L. Smith, and Gerard D. Pfeifer: Ethyl Corporation; and John G. Reynolds: Lawrence Livermore National Laboratory
An Overview of CIIT's Manganese Research Program
D.C. Dorman, K.A. Brenneman, M.F. Struve, R.A. James, B.E. McManus, and B.A. Wong: Chemical Industry Institute of Toxicology

JUNE 4 14:00-17:00 SESSION 2: MECHANISMS OF TOXICITY
Effects of Manganese on Oxidative-Stress in CATH.a Cells
Michael Aschner, Jeffrey W. Allen, and Cynthia G. Worley: Wake Forest University School of Medicine
Influx Kinetics of Manganese, Manganese Citrate and Manganese Transferrin into the Brain
J.S. Crossgrove, S.S. Rhineheimer, and R.A. Yokel: University of Kentucky Medical Center
Effects of Manganese on the Developing Rat Brain: Oxidative-Stress Related Endpoints
Michael Aschner and Sarah Weber: Wake Forest University School of Medicine, David C. Dorman: Chemical Industry Institute of Toxicology; and Lawrence H. Lash: Wayne State University
The Uptake of Manganese in Brain Endothelial Cultures
Michael Aschner, Jeffrey W. Allen, Gouri Shanker, and Lysette A. Mukus: Wake Forest University School of Medicine
Measurements of the Oxidation State of Manganese Inside Brain, Heart, and Liver Mitochondria Using XANES Spectroscopy

Mechanisms of Manganese-Induced Rat Pheochromocytoma (PC12) Cell Death and Cell Differentiation
Jerome A. Roth, Li Feng, Jennifer Walowitz, Richard W. Browne, and Michael Garrick: State University of New York, Buffalo

Disordered Iron Metabolism Following Manganese Exposure: From Systemic Iron Homeostasis to Cellular Iron Regulation
W. Zheng: Columbia University

Neurotoxicity of Inhaled Manganese
J. Zayed: University of Montreal

JUNE 5 8:30 - 10:30 SESSION 3: PHARMACOKINETICS & MISCELLANEOUS PAPERS
Influence of Dietary Manganese on the Pharmacokinetics of Inhaled Manganese Sulfate in Male CD Rats
Dorman, D.C, Struve, M.F., James, R.A., McManus, B.E., Marshal, M.W., and Wong, B.A.: Chemical Industry Institute of Toxicology

Particle Solubility and Delivery of Inhaled Manganese to the Rat Brain: Manganese Sulfate and Manganese Tetroxide Pharmakokinetics Following Repeated “Open 14-Day” Exposure
Struve, M.F., James, R.A., Marshal, M.W., Parkinson, C.U., Wong, B.A. and Dorman, D.C: Chemical Industry Institute of Toxicology

Brain Manganese Efflux through the Blood-Brain Barrier
R.A. Yokel, S.S. Rhineheimer, and B.L. Bukaveckas: University of Kentucky Medical Center

Direct Olfactory Transport of Inhaled Manganese to the Rat Brain: Toxicokinetic Investigations in a Unilateral Nasal Occlusion Model

Where Does the Manganese Come From? Metal Quantities and Associations in Modern Alluvium of the Mississippi River Delta

Manganese Treatment Induces Dose-Related Decreases in the Activities of Several Glycolytic and TCA Cycle Enzymes in Neuroblastoma and Astrocytoma Cells
G.V. Malthankar, B.K. White, D.S. Hanson, C.L. Hanson, A. Bhushan, C.K. Daniels, K.J. Rodnick, and J.C.K. Lai: Idaho State University

Uptake of Manganese Dioxide to the Rat Brain: Role of Particle Size in a Nose-Only Inhalation Exposure
Fechter, L.D., Johnson, D.L., and Lynch, R: University of Oklahoma Health Sciences Center

JUNE 5 11:00-16:30 SESSION 4&5: HUMAN HEALTH & EPIDEMIOLOGY PART I & II
Exposure, Neurobehavioural Performance and Hormone Status of Workers Exposed to Manganese in the Production of Manganese Alloys
Dag G. Ellingsen, Rita Bast-Pettersen, Siri Hetland, and Yngvar Thomassen: National Institute of Occupational Health
Manganese Exposure and Parkinson’s Disease: a Comparison Using Two Tremor Characteristics
Gabriel Lambert, Anne Beuter, and Brenda MacGibbon: UQAM, Montreal

Characterization of Workers Exposure in the Production of Manganese Alloys
Yngvar Thomassen, Siri Hetland, and Dag G. Ellingsen: National Institute of Occupational Health and Hugo Ortner: Technical University of Darmstadt

An Investigation of Potential Nervous System Effects of Manganese at a South African Smelting Works
Myers, J.E., Thompson, Mary Lou, Young, T., Ramushu, S., Esswein, Naik, I, Iregren, A, Rees, D, London, L.

Biomarkers for Environmental Manganese Exposure: Useful Ranges for Different Exposure Scenarios
Myers, J.E., Naik, I, Thompson, Mary Lou, Ramushu, S., Esswein, E.

Manganese and Prion Disease
David R. Brown: University of Cambridge

Risk Assessment of Manganese in the Development of Prion Diseases
Lamoury F, Burel M, Marce D, and Deslys J-P, CEA

Dopaminergic Dysfunction Following Long-term Occupational Exposure to Manganese
Raffn E., Arlien-Søborg P., Thomsen C, Friberg L, Hillerød and Copenhagen

A Novel TLV for Inorganic Manganese Compounds
Karen R. Obenshain, Martha M. Marrapese, and David G. Sarvadi: Keller & Heckman LLP

JUNE 6 8:30-12:30 SESSION 6: MANGANESE AND THE NERVOUS SYSTEM

Effects from Occupational and Environmental Exposure
Roberto Lucchini: University of Brescia

No-observed Adverse Effect Level for Early Psychomotor Dysfunction in Workers Exposed to Manganese Dioxide

Determination of an Occupational Exposure Guideline for Manganese Using the Benchmark Method
Kenny S. Crump and Harvey J. Clewell: ICF Consulting

A Risk Assessment for Manganese that Considers Its Essentiality
Harvey J. Clewell: ICF Consulting and Melvin E. Anderson: Colorado State University

Is Increasing Environmental Exposure to Manganese Disturbing the Delicate Balance of an Essential Element?
Donna Mergler: Université du Quebec a Montreal

A Response Outlining Research Needs Arising from Questions Above
Michael Aschner: Wake Forest University

Roundtable with Open Discussion and Indication of Research Needs
Chairs Host – All Participate