# 12th Biennial Worldwide Conference on Refractories 2011

**(UNITECR 2011)** 

Kyoto, Japan 30 October - 2 November 2011

ISBN: 978-1-62276-104-3

#### 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.

Copyright© (2011) by UNITECR 2011 All rights reserved.

Printed by Curran Associates, Inc. (2012)

For permission requests, please contact UNITECR 2011 at the address below.

Secretariat of UNITECR 2011 c/o the Technical Association of Refractories, Japan New Ginza Bldg., 7-3-13 Ginza, Chuo-Ku, Tokyo 104-0061, Japan

Phone: +81-3-3572-0705 Fax: +81-3-3572-0175

Unitecr-info@tarj.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: 845-758-2634

Email: curran@proceedings.com Web: www.proceedings.com

### CONTENTS

Preface ·····1
Contents of General Papers · · · · · · · · · · · · · · · · · · ·
Special Article · · · · · 15
Opening Ceremony · · · · · 36
Plenary Lecture · · · · 37
1. Development and Evolution of Japanese Steel Industry
Mr. Norio Katsuyama (Representative Diector and Eecutive Vice President,
Nippon Steel Corporation)
3. Global Hydrological Cycles, World Water Resources, Water Footprinting and
Sustainable Development under Global Changes
Prof. Shinjiro Kanae (Graduate School of Information Science and Engineering,
Tokyo Institute of Technology)
Contents of General Papers ·······42
Author Index 987

## **Contents of General Papers**

Monolith	nics for Various Applications	
31-A-1	Thermo-Mechanical Study of a Refractory Castable for Petrochemical Riser	42
	Marcelo Dezena Cabrelon, Antonio Henrique Alves Pereira, Jorivaldo Medeiros and	
31-A-2	Jose de Anchieta Rodrigues  Influence of the Firing Atmosphere on Alumina Based Refractory Castables Used in Slagging Gasifiers	46
31-71-2	PatrickGehre, Claudia Wenzel and Christos G. Aneziris	70
31-A-3	New Materials for Increased Campaign Cupola Furnaces	50
	Silvio Cassavia Frasson, Sergio Murilo Justus, Vladnilson Peter de Souza Ramos, Renato Antonio,	
	Roberto Cristiano, Mauro Mueller and Roni Cardoso da Silva	
31-A-4	Plastic Refractory for Reheating Furnace in China	53
	Yang Wu and Wenyong Dai	
31-A-5	Development of New Dry Gunning Method	57
	Yoshihiro Mizuma, Hiroshi Ebisawa, Hiroki Ohata, Hiroyoshi Tomono, Tsuyoshi Matsui,	
31-A-6	Hiroaki Otsubo, Hironori Takeuchi and Masaharu Satou Japan Development of Non Wettable and Corrosion Resistance High Alumina Castable for Aluminium	
31-A-0	Industry	61
	Pabitra Sahu, Bharati Krushna Panda, Nilachal Sahoo and Jai Narayan Tiwari	01
31-A-7	Changes in Phase Composition and Microstructure of Al <sub>2</sub> O <sub>3</sub> -Si-Al Composite during Heating	64
	Xin HongLiu, Fang bao Ye and Xiang chong Zhong	
31-A-8	Development of Technique for Continuous Thermometry of Melting Furnace	68
	Akihisa Komada, Koh Arakawa and Masahiro Nishimura	
31-A-10	Corrosion of Refractory Castables Lining the Tube Walls of Waste Incinerators	
	Post-mortem Sample Analysis and Shimulation Test	72
	Pierre Meunier and Pascal Prigent	
Refracto	ries for Steel Refining	
	Improvement of Lance Refractories for Hot Metal Pretreatment	77
	Hiroki Uchiyama	
31-B1-2	Study of the Wear of MgO-C Bottom-Blowing Tuyeres in Converters and Improvement of	
	Service Life	81
24 54 2	Kazuya Maruyama, Kiyoto Kasai, Takayuki Inuzuka and Tsuyoshi Matsui	0.0
31-B1-3	Wear Mechanism of MgO-C Bricks for Steel Ladles Slag Line	83
	Sávia Cristina Lacerda Poubel Bastos, Marco Antonio Quintela, Fábio Duarte do Santos, Caio Cesar Dente Exposito and Jose de Anchieta Rodrigues	
	Calo Cesai Dente Exposito and Jose de Aficineta Rodrigues	
31-B1-4	The Effect of Antioxidants on Physical Properities of MgO-C Bricks	87
	Kuo Chang Lee, Shuo Cheng Chang and Pao Tsai Chen	
31-B1-5	Hydration Resistance Evaluation of Steelmaking Refractories	90
	Pablo German Galliano, Leandro Martorello, Leonardo Musante, De Micco and Analia Tomba	
31-B1-6	Improvement of Spalling Resistance on Low Carbon MgO-C Bricks	94
	Masayoshi Kakihara, Minoru Suto and Hidenori Tada	
31-B1-7	Characterization of Expansive Behavior of Al <sub>2</sub> O <sub>3</sub> -MgO-C Refractory due to Spinel Formation	07
	in-situ  Sentana Malikana dharay Sulauman Adala Amin Kaman Chattana dharay Canaak Chandus Das and	97
	Santanu Mukhopadhyay, Sukumar Adak, Arup Kumar Chattopadhyay, Gopesh Chandra Das and Saikat Kumar Maitra1	
31_B1_8		101
31 <b>D</b> 1 0	Shengli Jin, Thomas Auer, Dietmar Gruber, Harald Harmuth, Marc H. Fréchette and Yawei Li	101
31-B1-9	Online Monitoring System of Refractories for Improvement of Steel Ladle Heats at Kakogawa	
	Works	105
	Tsutomu Yoshimoto, Norio Sakaguchi, Tetsuji Tokonami, Kou Kobayashi, Toshiya Ozato,	
	Takao Tanaka and Yoshihiro Noguchi	
Educatio	on and Training	
	on and Training  The Relevance of Global Refractories Education to the Refractories End User	109
J. D2-1	Sido Sinnema	10)

31-B2-2	Toward Sustainable Refractory Education - A Service Engineering Approach	112
24 72 2	Anja Geigenmueller	116
31-B2-3	How to Improve Technology Transfer in Refractory Science and Engineering	116
21 D2 4	Anja Geigenmueller  Education of Engineering Design in Some Janeanse Universities	120
31-B2-4	Education of Engineering Design in Some Japanese Universities Yasuro Ikuma	120
21 D2 5	New Challenges and Old Tools: The Refractory Area Dilemma (Invited)	N/A
31-02-3	Victor Carlos Pandolfelli	11/71
31-B2-6	Recruiting, Training, and Developing the Next Generation of Refractory Engineers	123
01 22 0	Marc N. Palmisiano	120
31-B2-7	Freiberg and Bologna - The Freiberg Way of Education in the Field of Ceramics	127
	Kathrin Haeussler and Christos G. Aneziris	
31-B2-8	How to Promote Natural science and Engineering - Freiberg Submissions for Pre-school up to	
	High School Education	129
	Kathrin Haeussler	
31-B2-9	Refractory Education in Ukraine	134
24 72 4	Valeriy Vladlenovich Martynenko, Michail Ivanovich Ryschenko and Yaroslav Nicolaevich Pitak	100
31-B2-10	Teaching Refractories In Germany	136
21 D2 11	Thorsten Tonnesen and Rainer Telle	127
31-B2-11	FIRE: Focusing on Innovation and Education (Invited)	137
	Michel Rigaud	
Rasic Sc	ience: Castables	
31-D-1	Effect of Binding System on Cold and Hot Strengths of SiC Based Castables after Nitridation	141
	Huifang Wang, Ningsheng Zhou, Yubao Bi, Qingxin Meng and Sanhua Zhang	
31-D-2	Gel bond Castables Based on Microsilica as Binder	145
	Bjørn Myhre and Haibing Fan	
31-D-3	Effect of Light-calcined Coal Gangue Addition on Hot Strength and Thermal Shock Resistance	e
	of ULC Castables in Al <sub>2</sub> O <sub>3</sub> -SiO <sub>2</sub> System	149
	Ningsheng Zhou, Sisi Feng and Jiwei Li	
31-D-4	Magnesia-rich Complex Spinel Bonded Basic Castables	153
	Rahul Lodha, Hamidreza Zargar, George Oprea and Tom Troczynski	
31-D-5	Hot Strength Enhancement of High Alumina ULC Castables by In Situ Formed Bonding Phases	157
21 D (	Zhenyong Bi, Ningsheng Zhou, Jialin Sun, Jiwei Li, Deting Xu and Qian Peng  Photological Free leating Methods for Vibrated Contables and Continue Mines	171
31-D-6	Rheological Evaluation Methods for Vibrated Castables and Coating Mixes Xiying Cao, Shouye Wang, Zhanmin Wang, Haixia Feng and Jinxue Liu	161
31-D-7	Fundamental Investigation on Slag Corrosion of Oxide Ceramics	165
31 <b>-</b> D-7	Naoya Enomoto, Shoko Sawano, Junichi Hojo and Hideyuki Tsuda	103
31-D-8	The Effects of Graphite Addition on Properties of Alumina Refractory Castable	169
31 B 0	Lin Li, Yan Yang, Zhiyong He and Xiaoyan Peng	10)
31-D-9	Pressure Slip Casting of Shaped Coarse Grained Refractories	174
	Stefan Schafföner, Christos G. Aneziris and Uwe Klippel	
31-D-10	Role of Magnesium Sulfate Solution Impregnation in Properties Improvement of Alumina	
	Based Castables	178
	Renhong Yu, Ningsheng Zhou, Penghui Du and Shiying Ren	
31-D-11	Effect of Calcium Aluminate Binder and MicroSilica on Thermo-Mechanical Properties of Lov	
	Cement Castables	182
	Arup Kumar Samanta, Smita Satpathy, Sukumar Adak and Arup Kumar Chattopadhyay	
T 111	Define the river for Charles	
	Refractories for Steel Study and Application on Magnesia Forstorita Dry Vibration Material for Tundish	10/
31-E-2	Study and Application on Magnesia-Forsterite Dry Vibration Material for Tundish	186
31-E-3	Yong Chen, Jing Kun Yu, Ming Liang Gan, Shi Feng Song and Chang Ping Chen  Experiences of Non-vibratable, Dry Installed Inorganic Tundish Coating Materials	190
31-E-3	Jukka Pekka Vatanen, Kyösti Elias Ruotanen and Jarkko Matias Matkala	190
31-E-4	Characteristics and Application of Dry Vibrating Mass for Tundish Lining	195
21-D-4	Raghunath Prasad Rana, Atanu Suvrajit Bal, Pralay Chakraborty, Sukumar Adak and	173
	Arun Kumar Chattonadhyay	

31-E-5	Interaction Between Molten Steel and MgO-based Tundish Lining: a Potential Source of Non-metallic Inclusions	199
	Mario Cesar Mantovani, Luiz Roberto Moraes Jr, Edson Fernandes Cabral, Robson Leandro Silva,	
	Egberto Antonio Possente, Mauricio Marino Ura, Almir Murari, José Antonio Bueno Barbosa Braz	
	Celso Antonio Barbosa and Bruno Pessoa Ramos	.11,
	CCISO Altonio Daroosa and Diuno i Cssoa Ramos	
Bricks fo	or Various Applications	
31-E-6	Development of High Creep Resistant 50% Grade Alumina Brick for Anode Baking Furnace	
	Application	203
	A.Chakrabarti, S. Das, B. Ghosh, S. Adak, P.B.Panda and A.K.Chattopadhyay	
31-E-7	Dusting Phenomenonon of Magnesia-Chrome Brick	206
	Yasutaka Sugimoto, Naoyuki Nishimura and Yoshikazu Noda	
31-E-9	Selection of Refractory Quality and Design Pattern for Bottom Application in High Capacity	
	Steel Ladle	210
	Shankha Chatterjee, Michel Sulkowski and Lucyna Obszynska	
31-E-10	Preparation of High-Density Magnesia from Natural Magnesite	214
	Jingkun Yu, Pengcheng Ma, Huan Li and Lei Yuan	
Fnyiron	mental Sustainability & Recycling	
1-A-1	Evaluation of Carbonation to Inhibit Leaching of High-Alkaline Solution from Steelmaking Slag.	218
1-71-1	Shunsuke Matsui and Naoto Tsutsumi	210
1-A-2	Properties and Application of MgO-CaO Clinker with Excellent Hydration Resistance	222
1-71-2	Guotian Ye, Yanhu Bi, Min Zhang and Xiaomin Cui	
1-A-3	Testing of High Emmissivity Coatings for Reheat Furnace Application	225
1 11 5	James W. Stendera and Samuel B. Bonsall	223
1-A-4	MgO-C Bricks Using Carbon Neutral Binder.	229
	Ryosuke Jozuka, Toshiyuki Hokii, Manabu Kimura, Hiroyuki Fuchimoto and Katsuhiro Ishimoto	
1-A-5	Development of Refractory Industry in China with Restricts of Resource, Energy and	
	Environment Factors (Invited)	233
	Hongxia Li	
1-A-6	A New Proposal for the Methods of Reducing Heat Loss without Decrease of Working Lining Life	237
	Eizo Maeda	
1-A-7	The Properties and Application of Aggregates with Lower Bulk Density	241
	Nan Li, Conghua Peng and Wen Yan	
1-A-8	Development of New Castable for Ladle Work Lining to Control Heat Loss	244
	Masafumi Nishimura, Hisaharu Sasaki and Makoto Namba	
1-A-9	Research of Properties of Insulating Castable Based on Microporous Calcium Hexaluminate	
	80 8	248
	Valeriy Vladlenovich Martynenko, Vladimir Primachenko, Natalya Kaznacheeva,	
	Inna Kostyrko, Yulia Krahmal' and Pavel Krivoruchko	
1-A-10		252
	Eric Sako, Mariana Braulio, Enno Zinngrebe, Sieger van der Laan and Victor Pandolfelli	
1-A-11	Recycling of MgO-C Scrap from BOF with High Al Content	256
	Daniele Fonseca de Lima, Manuel Gustavo Lutkenhaus, Aloyso Figuereido Junior and	
	Carolina Coelho Novais	2.60
1-A-12	8	260
1 4 12	Hiroaki Morii, Hitoyoshi Kinoshita and Shinji Adachi	262
1-A-13	·	263
1 4 14	Astrid Volckaert, Franz Maier and Robin Schmidt-Whitley	267
1-A-14	• 0	267
1 1 15	Shigeyuki Maruyama, Hiroto Tsuda and Eiji Motoki Ovidetion Pelovian of Mac Peaced Coatable Propagad Using Cayabad Prioles Aggregates	271
1-A-15	1 0 00 0	271
1 Λ 16	Ana Luisa Rivas, Delia Gutierrez, Jeffrey D. Smith and Todd P. Sander	275
1-A-16	e e	413
	Hiroyuki Tanida, Yoshiki Tsuchiya, Yoshiharu Kajita, Yutaka Ishikawa and Fumihito Ozeki	

1-A-17	Effect of Apparent Porosity on Generation of Hexavalent Chromium Compounds in	
	Refractories Including Cr <sub>2</sub> O <sub>3</sub> for Waste Melting Furnace	279
	Shinji Mizuhara, Takeo Urabe, Akira Yamaguchi and Tomoyuki Maeda	
1-A-18	Formation of Hexavalent Chromium in Chromite and Chromic Oxide Containing Refractory Materials	283
	Andrie Mariana Garbers-Craig and Misheck Nyoka	
1-A-19	Non-Cement Chrome-free Castables for Waste Melting Furnace	287
	Kazuki Nishida and Yoshimasa Miyagishi	
1-A-20	Refractories for the Waste Melting Furnaces	291
	Wuhua Wu, Junichi Moda and Kunihiko Tanaka	
1-A-21	Development of Advanced Castables for Waste Melting Furnace	295
	Hideyuki Tsuda and Kakuichi Murakami	
Refracto	ories for Steel Refining	
1-B1-2	Development of Soft Plastic Material which has a Good Workability and Ability of Crack	
	Prevention with Special Fiber	299
	Hiroyuki Suzuki, Toshifumi Nihari, Hideyuki Tasaki and Yusuke Naito	
1-B1-3	Wear Behavior of MgO-Cr <sub>2</sub> O <sub>3</sub> Brick in RH Process	305
	Chang-su Ha and Doo-hoa Jeong	
1-B1-4	Corrosion of RH Bottom Vessel Refractories - Part 1: Kinetic Model to Predict Slag and Meta	l
	Compositions During the RH Process	309
	Marie-Aline Van Ende, Young-Min Kim, Mun-Kyu Cho, Juhan Choi and In-Ho Jung	
1-B1-5	Case Studies in the Localized Wear of Magnesia Chrome Refractories in Vacuum Circulation	
	Degasser	313
	Yong M. Lee, Kevin Ahlborg and Jim Cottrell	010
1-B1-6	RH Degassers Operational Conditions in Brazil, a Challenge for Refractory	317
1 21 0	Ana Paula de Miranda Mati, Geraldo Eduardo Gonçalves, Geraldo Ildeu Lara, Sérgio Eustáquio	51,
	Soares, Eric Novaes Almeida and Modestino Alves de Moura Brito	
1-B1-7	Fired Chrome Free Basic Bricks Development for 2nd Refining Furnace	321
1-101-7	Seyoung Um, Sangwon Lee and Kangyong Lee	321
1-B1-8	Thermal Stress Analysis of the Slot Purging Plugs in LF Refining Process	325
1-D1-0	Zhongyang He, Qiuhua Fu, Xiao Wu and Baikuan Liu	323
1-B1-9	Characteristic of MgO Porous Plug	329
1-D1-9	Takayuki Komura and Akihiro Tsuchinari	329
1_R1_10	Improvement in Wear Resistance of Porous Plug During Oxygen Lance Cleaning Operation	332
1-D1-10	Eiji Ishihara	332
	Liji ishindid	
Now Too	ts and Testing Deveropment	
	Control of Average Slab Temperatures Using a State-space Furnace Model	336
1-D1-11	Hans J. Wick	330
1_R1_12	Evaluation of the Hot Permeability in the Alumina-Graphite Porous Materials	339
1-D1-12	Yoshiyuki Kondou, Tamotsu Wakita, Katsumi Morikawa and Joki Yoshitomi	339
1 R1 13	Localization of Structural Heterogeneities in Refractory Blocks Using Ground Penetrati	na
1-D1-13	Radar	343
	M. Boinet, P. Pires Franco, A. Crouzet, L. Massard, M. Gaubil and C. Norgeot	343
1 D1 1/	Non Destructive Inspection of the Refractory Lining Using the Radiation	347
1-D1-14	Takuo Uehara, Hitoshi Nakamura	347
1 D1 15		• • • •
1-D1-13	Studies on Wear of Unshaped Al <sub>2</sub> O <sub>3</sub> -SiC-C Materials by Means of Optical Cathodoluminescer	
	Microscopy: A fast, Powerful Method To Distinguish between Refractory Melt Interactions and Thormally and no. induced in situ Metaviol Alteration (Invited)	
	Thermally and pO <sub>2</sub> induced in situ Material Alteration. (Invited)	351
	Olaf Krause, Yannick Hemberger, Volker Presser, Jörg Zimmermann, Christoph Berthold and	
1.01.11	Klaus Nickel	250
1-B1-16	Impact Strength of Aluminium Titanate with Low Elasticity	359
	Akemi Hayashi, Nobuyasu Adachi, Toshitaka Ota, Yasuhisa Sekiya, Guillaume Sauget and Marc	
	Huger	
1-B1-17		363
	Tobias Hölscher, Hans-Jürgen Schneider, Ernst Schlegel and G. Aneziris	

1-B1-18	Development of Test Method for Abrasion Resistance at Elevated Temperatures of	
	Refractories	367
	Xigao Peng, Gan Shi and Xiaohui Zhang	
1 R1 10	Destruction Behavior Observation of Refractory by Mechanoluminescence	371
1-D1-17	Masayuki Shigeno, Makoto Ishikawa and Yasuhiro Ohba	3/1
1 D1 20	· · · · · · · · · · · · · · · · · · ·	275
1-B1-20	Characterization of Non-Metallic Melts By Aero Acoustic Levitation	375
	Rainer Telle, Arno Kaiser and Paul Nordine	
1-B1-21	Thermal Conductivity of Ceramic Fiber Blanket Measured by Guarded Hot Plate Method and	
	Hot-Wire Method	379
	Koji Shiono, Hidenao Suzuki and Tadashi Ohtsuka	
Advance	s in Manufacturing, Installation and Equipment	
1-B2-1	The Influence of Type and Quantity of Dispersing Additives on the Properties of Vibrocast	
	Grain Masses and Products from Y <sub>2</sub> O <sub>3</sub> -stabilized ZrO <sub>2</sub>	383
	Valeriy Vladlenovich Martynenko, Vladimir Primachenko, Irina Shulik and Pavel Kuschenko	202
1-B2-2	The Optimum Conditions of SiC Refractories for the Progressive Microwave Kiln	387
1-DZ-Z	•	307
1 D2 2	Hisanori Hoshizuki, Yuji Maki, Fumihito Ozeki and Yoshiharu Kajita	
1-B2-3	Microwave Combustion Equipment for High Efficient Recovery of Precious Metals Absorved in	
	Activated Carbon	391
	Hironobu Taguchi, Takao Usami, Hisanori Hoshizuki and Yoshiharu Kajita	
1-B2-4	A New Packing Technology for Filling Refractory Products	395
	Engelbert Koess	
1-B2-5	Fabrication and Properties of Ultra-High-Porous Ceramics	399
	Ayumi Tsujino, Yuji Maki and Yosuke Tanaka	
Refracto	ry Engineering Systems and Design	
1-B2-6	Research on Specialized Program-Control Arc Furnace for Fused Cast Refractory	403
	Mao Limin, Feng Zhongqi, Yuan Lin, Zeng Haijun and Long Xicheng	
1-B2-7	Co-boiler Refractory Lining Failure Analysis and Re-design	N/A
1-02-7	Pinaki Prasad Lahiri, Prasenjit Saha and Biswarup Sarkar	11/11
1 D2 0		106
1-B2-8	Effects of Dry Joints on Compressive Behaviour of Refractory Linings	406
	Kirill Andreev, Sido Sinnema, Amna Rekik, Eric Blond and Alain Gasser	
1-B2-9	Development of Vertically Grooved Energy Efficient Crucible	410
	Takashi Hori and Shinnosuke Takeuchi	
1-B2-10	Refractory Design-Key Issue in Performance	413
	Prasenjit Saha, Prasenjit Pal and Pinaki P Lahiri	
1-B2-11	Evaluation of Stress-relaxation in Basic Bricks for Rotary Cement kilns	416
	Yoshihiro Toda, Hidenori Tada and Koichi Igabo	
1-B2-12	Solid Solution Effects on the MgAl <sub>2</sub> O <sub>4</sub> -MgGa <sub>2</sub> O <sub>4</sub> System	420
	Kelley R. O'Hara, Jeffrey D. Smith, Todd P. Sander and James G. Hemrick	
1-B2-13	High Performance Regenerator for Glass Melting Furnace	424
	Masakazu Namba and Masami Kitano	
1_R2_14	Modeling and Optimizing Physical Properties of High Pure Silica Brick	426
1-D2-14	Wang Jiezeng, Yuan Lin, Ye Yahong, Li Penghai and Wang Juntao	720
1 D2 15		
1-B2-13	Reduction of Ceramics Sintering Energy Consumption Rate Using Emissivity Difference of Kil	
	Furniture	430
1.00.16	Shigeru Hanzawa	42.4
1-B2-16	Flow Optimization in the Mould by Port Design Improvement of Submersed Entry Nozzle	434
	Takahiro Kuroda, Arito Mizobe and Jouji Kurisu	
1-B2-17	Air Tight Tundish Sliding Gate System	438
	Hyoung-gon Lee, Young-ho Kim, Yong-han Na, Sang-Ahm Lee, Sik Sunwoo and Do-Mun Choi	
1-B2-18	Continuous Aluminum Melting and Holding Crucible Furnace	442
	Yusuke Sano and Masahiro Kuritani	
1-B2-19	Development of High Penetrating Injection Refractory at Hot Temperature in Blast	
	Furnace Hearth	445
	Atsuya Kasai, Shougo Matsuura and Toshihiro Watanabe	

1-B2-20	Thermomechanical Behavior of a Blast Furnace Stave	449
	Fabien Nazaret and Pierre Meunier	
1-B2-21	Improvement in the Productivity and Steel Quality by Introducing Innovative Solutions for Tundish	453
	Patrick Tassot, Christian Turrel, Olof Jonsson and Jacky Wang	
	es for Steel	
1-D-1	Spinel Castables For Steel Ladle Lining: In-situ Versus Preformed	457
	Andreas Buhr, Marion Schnabel, Jerry Dutton Reinhard Klaus Exenberger and Christian Rampitsch	
1-D-2	Basic Slag Corrosion of MgAl <sub>2</sub> O <sub>4</sub> -containing Refractory Castables for Steel Ladle Applications	465
	Mariana Braulio, Ana Paula Luz, Analía Tomba Martinez and Victor Pandolfelli	
1-D-3	Effect of SiC Content on Slag Resistance of Magnesia Based Castables	469
	Wen Yan, Nan Li, Bingqiang Han, Guangping Liu, Yuanyuan Li and Chong Wang	
1-D-4	Castables with Improved Corrosion Resistance for Steel-making Applications	472
	Genine Assis, Chris Parr, Hervé Fryda, Jean-Michel Auvray and Christoph Wöhrmeyer	
1-D-5	New Spinel Containing Calcium Aluminate Cement for Corrosion Resistant Castables	476
	Christoph Wöhrmeyer, Chris Parr, Genine Assis, Hervé Fryda, Jean-Michel Auvray, Bruno Touzo and	
	Sabine Guichard	
1-D-6	Effect of Particle Size Distribution on the Fluidity of Alumina-Magnesia System Castables	480
	Aya Kusunoki, Yoshitaka Sadatomi, Yoshihiro Sasatani and Tsubasa Nakamichi	
1-D-7	Effect of Aluminum Powder with Different Grain Size on Properties of Alumina Castables	484
	Yasuhiro Ohba, Takanori Nakano, Hirohide Okuno and Makoto Ishikawa	
1-D-8	The Effect of a sepiolite-based Addition on the Properties of Refractory Castables	488
	Izabela Kamila Majchrowicz and Teresa Wala	
1-D-9	Improvement of Shotcast Material for Torpedo Cars	492
1.70.10	Yasuhiro Yamada, Masahiko Amano, and Nobuyuki Takahashi	10.6
1-D-10	New Ceramic Bonding (Refractory Matrix) - Reactive Andalusite	496
1.5.11	Xiao-Yong Xiong, Angelika Ressler and Michael Weissenbacher	<b>=</b> 00
1-D-11	Chemical Additives for Castables	500
1.7.10	Joachim von Seyerl	<b>70</b>
1-D-12	Refractory Castables Containing SnO <sub>2</sub>	504
1 D 12	Andrzej sliwa, Józef Wojsa, Leslaw Jedynak and Jacek Podwórny	<b>500</b>
1-D-13	Analysis of Drying Process for Castables Refractories	508
1 D 14	Satoru Shimizu, Koji Yamaguchi, Yoshisato Kiyota and Hisahiro Matsunaga	
1-D-14	Analyses of the Thermal Deformation Behavior of the Al <sub>2</sub> O <sub>3</sub> -MgO Castables by Digital Image	510
	Correlation Method	512
1 D 15	Hidetoshi Kamio, Yoshihiro Sasatani and Mitsuo Sugawara	<i>516</i>
1-D-15	Characterisation of High Temperature Reaction and Cracking in Spinel Forming Castables	516
1 D 17	Thomas A. Bier and Christoph von Gynz-Rekowski	
1-D-17	QD NCC: Quick Dry No Cement Castables. A Novel Non-cementitious Mineral Bond	520
	Permitting Extreme Rapid Dry out of Monolithic Refractory Linings Jerome Soudier	520
1 D 10		
1-D-18	QD NCC: Quick Dry No Cement Castables. Implementation and Evaluation of Performances of a Novel Bond System in Castables for Diverse Applications	524
	*	524
1-D-19	Jerome Soudier, Patrick Malkmus, Vladimir Bardin and Pierre Meunier	
1-D-19	QD NCC: Quick Dry No Cement Castables. Industrial Feedback on Implementation of a Novel Bond System in Castables for Foundry Applications	528
	Jonas Oldin, Andrew Fowler and Jerome Soudier	320
1-D-20	Influence of Carbon Source on Some Properties of MgO Castables	532
1-D-20	Delia Gutierrez-Campos, Jeffrey D. Smith and Todd P. Sander	332
	Dena Guneriez-Campos, Jerricy D. Simur and Todd 1. Sander	
Bricks fo	or Various Applications	
1-E-1	Investigation of Refractory Lining Failure In A Caustic Incinerator	536
1-1/-1	Manabendra Kumar Maity, Eissa Saleh Al Zahrani, Fakhruddin Habiby and Ruchuan Yin	220
1-E-2	Chromic Oxide-Zirconia Bushing Blocks for the Fiberglass Production Furnaces	539
1 11-2	D. Valeriy V. Martynenko, Sc. Vladimir V. Primachenko, D. Pavel P. Kryvoruchko,	
	D. Yuliya Ye. Mishnyova, Elena I. Siniukova, Tatyana G. Tishina and Alexandr M. Kuz'menko	

1-E-3	Measurement of the Volume Expansion of SiC Refractories Induced by Molten Salts Corrosion Pascal Prigent, Emmanuel De Bilbao, Nicolas Schmitt, Jacques Poirier,	543
	Eric Blond and Marie-Laure Bouchetou	
1-E-4	Quality Control Management of Refractory SiC for Waste Incineration Plants Thorsten Tonnesen and Rainer Telle	547
1-E-6	Fatigue Fracture Behavior of MgO-C brick	551
	Yuta Hino and Oshisato Kiyota	
1-E-7	Fatigue Failure Behavior of Al <sub>2</sub> O <sub>3</sub> -SiO <sub>2</sub> System Bricks Under Compressive Stress	555
1-E-8	Yuta Hino and Yoshisato Kiyota Effects of ZrO <sub>2</sub> Content and Y <sub>2</sub> O <sub>3</sub> Addition on the Properties of MgO-ZrO <sub>2</sub> Refractory	559
	Jingkun Yu, Chun Wang and Lei Yuan	
1-E-9	Slag Corrosion Resistance Behavior of MgO-ZrO <sub>2</sub> Refractory Yuan Lin, Chen Songlin, Zeng Luju, Liu Xijun, Wu Xingsheng, Sun Jialin and Wang Shoujie	563
Dosio Co	cience: Chemical Reaction	
1-E-11	Improvement on the Oxygen Lance Corrosion of the Upper Nozzles for Tundish and Ladle	567
	Kentaro Iwamoto and Jouki Yoshitomi	
1-E-12	Corrosive Wear of Refractories in Steel Ladles- Part I: Fundamentals	571
	Harald Harmuth, Sandra Vollmann and Roman Roessler	
1-E-13	Corrosive Wear of Refractories in Steel Ladles- Part II: Influence of Fluid Flow Sandra Vollmann, Harald Harmuth and Andreas Kronthaler	574
1-E-14	Corrosion Behavior of Various Refractories in Molten Slag	578
1 1 1 1 5	Hiroyuki Sunayama	
1-E-15	Thermodynamic Database Development for CaF <sub>2</sub> -containing Oxide Systems and Applications	
	the Steelmaking Process	582
1-E-16	In-Ho Jung, Marie-Aline Van Ende and Dong-Geun Kim  Effect of Cyclic Thermal Treatment on the Corrosion Resistance of Magnesia Carbon Convert	ton
1-E-10	Bricks.	586
	Shingo Umeda, Tadashi Ikemoto and Kiyoshi Goto	300
1-E-17	Competitive Dissolution of MgO from Flux and Refractory	590
1-L-17	Shin-ya Kitamura, Nobuhiro Maruoka, Akira Ishikawa and Hiroyuki Shibata	370
1-E-18	Improvement in Alkali Resistance of Alumina Brick for Waste Incinerator, and Application	594
1 2 10	Takeshi Yamamoto, Yoshimasa Miyagishi, Tetsuo Kaji and Satoshi Sakamoto	571
1-E-19	Synthesis of Mullite from Different Precursors with Mechanically Activation	598
	Guotian Ye, Dayan Xu, Lei Liu and Liyin Li	
1-E-20	Effects of Polymer Addition and Supercritical Drying on Sol-gel HfO <sub>2</sub> Coating on	
	Polycrystalline SiC Substrate	602
	Takaya Akashi, Yosuke Katsuyama and Keiichiro Matsushima	
1-E-21	Corrosion of High Alumina Castables and Liquid Ashes during the Gasification of Sewage	
	Sludge	606
	Jacques Poirier, Romain Boigelot and Christine Bourgel	
Nozzles	& Plates for Steel	
2-A-1	New Tundish Nozzle with the Optimum Bore Profile	610
	Arito Mizobe, Takahiro Yasuda, Tetsuo Tsuduki, Jouji Kurisu, Kenichi Oki and Eizaburo Arimitsu	010
2-A-2	Performance of a New Tundish Nozzle at an Operational in a Steel Plant	614
	John Anthony Spink, Paul Cassar, Mark Noel Carberry, Arito Mizobe, Takahiro Yasuda and	
	Kenichi Ooki	
2-A-3	High Performance Nozzle with Inner Bore made of the MgO-C Material	618
	Akinari Sasaki, Katsumi Morikawa and Jyoki Yoshitomi	
2-A-4	Development and Application of Venturi nozzle with Anti-clogging Material	622
	Takeshi Kachi, Shigeaki Takahashi, Noriaki Yamauchi and Kazumi Oguri	
2-A-5	Development of Twin On-line Tundish Nozzle Changer for Beam Blank Casting	626
	Shinjiro Saito, Hiroaki Hayashi, Kenji Tachibana, Shunji Sadano, Haruyuki Ohba	
2-A-6	Development of New Unfired Slide Valve Plate Material	630
	Shinji Adachi and Yasushi Kawasaki	

2-A-7	Science and Practical Use of Metal Additives for Protection Against Low Temperature	
	Oxidation of Carbon Bonded Sliding Gate Refractories	634
	Mark R Snyder, Priyadarshi G Desai and Xianxun (Joe) Yi	
2-A-8	Low Thermal Expansion ZrO <sub>2</sub> System Raw Materials for Slide Gate Plate	638
2 4 0	Keiichiro Akamine, Masako Takenami, Kazuo Itoh Katsumi Morikawa and Jyoki Yoshitomi	(42
2-A-9	Effects of Alumina-zirconia Composite Powder on Properties of Zirconia Sizing Nozzle	642
2 4 10	Xiaoli Tian, Qunhu Xue and Chongbo Xue	(15
2-A-10	Evaluation of Slide Gate Valve Plate Material by the Reaction with Molten Steel	645
2-A-11	Naohide Hamamoto, Keisuke Inukai and Koji Moriwaki Thermal Shock Resistance of the High Durable Slide Gate Plate for the Ca Treatment Steel	649
Z-A-11	Zenta Ohmaru, Tamotsu Wakita, Jouki Yoshitomi and Yuya Uchida	049
2-A-12	Structure and Material Design of High Performance Functional Refractories for High-speed	
Z-A-12	continuous casting	653
	Hongxia Li, Guoqi Liu, Bin Yang, Wengang Yang and Jianbin Yu	055
2-A-13	Development of Anti-alumina-clogging Materials Characterized by Reaction with Molten Steel	657
2 11 15	Ryohei Suzuki, Masanori Ogata and Wei Lin	057
2-A-14	Development of Anti-clogging Immersion Nozzle by Electrochemistry	661
	Yasuhiro Sato, Yuichi Tsukaguchi, Kenji Taguchi, Toru Kato, Akifumi Muto, Kozo Ohta and	
	Shintaro Ohga	
2-A-15	Development of Advanced Submerged Entry Nozzle to reduce Alumina Clogging in Slab Casting	665
	Hiroyasu Niitsuma, Ian Mclennan, Hiromichi Suzuki, Shuji Shike, Paul Casser, Mark Camplin and	
	Joe Conte	
2-A-16	Development of Ladle Shroud and SEN with Heat-insulating Carbon-free Inside Liner	669
	Masanori Ogata, Wei Lin and Makoto Nakamura	
2-A-17	A Study on the Optimum SEN Design for Thin Slab Caster	673
	Chul young Park, Do-Mun Choi, Yong-Han Na and Sik Sunwoo	
2-A-18	Effect of Mold Powder Properties on Corrosion Rate of SEN ZrO <sub>2</sub> -C material	677
	Takuya Imaoka and Yukimasa Iwamoto	
2-A-19	Evaluation Procedure and Performance of Steel Ladle Well Nozzle Sand	681
	Rakesh K Dhaka and Teresa M Speiran	
N T	As and Testing December 4	
2-B1-1	sts and Testing Deveropment  Experimental Set-up for Mortar / Brick Interface Strength Characterization at High	
Z-D1-1	Temperature	685
	Eric Blond, Jerome Brulin, Emanuel De Bilbao, Amna ekik, Mathieu Landreau, Alain Gasser and	003
	Yannick Collevile	
2-B1-2	Digital Image Correlation Method for analyzing the Deformation Behavior of the Refractories	689
2 51 2	Hidetoshi Kamio	00)
2-B1-3	Correlation of Different Quenching Techniques and Resulting Elastic Properties of	
	Refractory Castable Formulations	693
	Nicolas Traon, Thorsten Tonnesen and Rainer Telle	
2-B1-4	Evaluation of the Drucker-Prager Parameters (Cohesion and Friction Angle) at Elevated	
	Temperature for Two Refractories	697
	Emilie Dahlem, Marc Huger, Thierry Chotard, Dietmar Gruber, Thomas Auer and Harald Harmuth	
2-B1-5	The Evaluation of Thermal Shock Damage in Refractory Castables Through Non-Linear	
	Resonance Acoustic Spectroscopy	701
	Antonio Henrique Alves Pereira, Alexandre Romao Costa Nascimento, Lucas Barcelos Otani and	
	Jose de Anchieta Rodrigues	
	ories for Iron Making	
2-B1-6	Development of Scientific Methodology for Reduction of Refractory Erection	705
	Time of Recovery type Coke Oven at JSW Steel Vijaynagar Works, India	705
2 D1 7	Asis Kumar Sarkar and Mohammed Azghar Ahmed	700
2-B1-7	Development of Refractory Solutions for Coke Oven Doors	709
	Sergio Murilo Justus, Vladnilson Peter de Souza Ramos, Silvio Cassavia Frasson, Bruno Amorim, Alvaro Elesbão, Pedro Sawamura, Joelma MianRabello, José Maria Clemente Brazil, Agnaldo	

2-B1-8	Corrosion Process of a High-alumina Brick Exposed to the Molten Iron	712
2 D1 0	Masaaki Mishima, Jyouki Yoshitomi and Tsuneo Kayama	716
2-B1-9	The Tap-hole Clay Development for Continuous Tapping Operation in Blast Furnace	716
2 D1 10	Won keon Kim, Soon il Yoon and Sang Ahm Lee  Pavalan mant and Application of Fac friendly High Parformance Silica Tan Hele Clay	720
Z-B1-10	Development and Application of Eco-friendly High Performance Silica Tap Hole Clay Houliangzhu, Shileijia, Wenfumiao, Guanghuiyan and Baikuanliu	720
2 B1 11	The development of carbon block with the high dense matrix for the blast furnace	724
Z-D1-11	Shigeru Morimoto, Shigeaki Takahashi ,Toshiyuki Muroi and Takayuki Sawada	124
2-B1-12		728
2 101 12	Takashi Iida, Masatsugu Kitamura and Yuki Niiya	720
2-B1-13	Development of Sol-Gel Bonded Al <sub>2</sub> O <sub>3</sub> - Sic -C Castable in Blast Furnace Trough Application	732
	Marcin Klewski and Michel Sulkowski	
2-B1-14	Trough Materials with Application of the Pitch-Coated Aggregates	736
	Nobuyuki Takahashi, Yasunobu Saruwatari and Hiroyoshi Tomono	
2-B1-15	Analysis About the Relation Between Blast Furnace Trough Corrosion Rate and Furnace	
	productivity	740
	Masakazu Iida and Kenji Suzuki	
2-B1-16	FEA Calculations to Guide Blast Furnace Main Runners Design	744
	Simon Chiartano	
2-B1-17	Effect of operating Conditions on the Deterioration of Castable used in the ML of Blast Furnace	
	trough	747
2 D1 10	Kosuke Yasuo, Masatsugu Kitamura and Takashi Iida	
Z-B1-18	Effect of Particle Size Distribution on the Pore Characters and Evolution of Al <sub>2</sub> O <sub>3</sub> -SiC-C Castable for Blast Furnace Main Trough	751
	Yucheng Yin, Yonghe Liang, Shan Ge, Zhiqiang Liu, Jianhua Nie, JiuChang Lu and HaiYan Dong	/31
2_B1_19	Improvement Lifetime of Trough Cover by Using Al <sub>2</sub> O <sub>3</sub> -SiC-C Castables	755
2-D1-17	Kun Min Chang, Su Shen Wu and Yu Chen Huang	133
	Trum trum entang, ou onto the una ru entant running	
Refracto	ories for Cement	
2-B2-1	Installation and Performance of Monolithic Materials with Graded Alkali Resistance	759
	Hans-Jürgen Klischat and Kai Beimdiek	
2-B2-2	New generation Mag Alumina Spinel Refractories for Cement Rotary Kiln	763
	Debasish Chandra, Nilachal Sahoo, Bhagirath Mishra, Jai Narayan Tiwari and Subhas Chandra Swain	
2-B2-3	New Chrome Free Brick for the Burning Zone of Rotary Cement Rotary Kilns	767
	Daniel Yukichi Kitaguchi, Makoto Ohno, Yoshiki Tsuchiya, Eiichi Nakajima and Yoshiharu Kajita	
2-B2-4	Development of Refractory Castables for use in Cement Kilns	771
	Vladnilson Peter de Souza Ramos, Silvio Cassavia Frasson, Sergio Murilo Justus and	
2 D2 5	Ariovaldo Nascimento	
2-B2-5	Investigation into Using Low-to Medium-Grade Bauxite-based Homogenized Grogs to Prepare	772
	the New-generation of Castables Used in Large-scale Dry-process Cement Rotary Kilns Linjun Wang, Jiancheng An, Yanling Wang, Yali Wang, Yunsheng Feng and Ping Li	773
	Emjun wang, Jianeneng An, Taming wang, Tan wang, Tunsheng Peng and Ping Er	
Raw Ma	terial Selection and Application	
2-B2-6	Effect of Blending of Quartzite on the Properties of Silica Bricks	777
	Saurav Ganguli, Biswajit Ghosh, Sukumar Adak, Priyabrata Panda and Arup Kumar Chattopadhyay	
2-B2-7	Thermal Expansion Properties of Roseki Materials	781
	Tomoaki Takisawa, Hisashi Tomiya and Minoru Suto	
2-B2-8	Dunite - A Versatile and Cost Effective Refractory Raw Material for Different Applications	785
	Kausik Banik, Sanat Kumar Hazra, Sukumar Adak, Priyabrata Panda and Arup Kumar Chattopadhyay	
2-B2-9	Review of Matrix Aluminas for Refractory Formulations	789
	Rainer Kockegey-Lorenz, Andreas Buhr, Dale Zacherl, Bin Long, Shigeo Hayashi and Jerry Dutton	
2-B2-10	Beach Sand Minerals -An Important Raw Material for Refractory Applications	795
2 D2 11	Himansu Sekhar Tripathi and Arup Ghosh	700
2-B2-11	New Reactive Aluminas for Refractory Castables	798
2 D2 12	Arnaud Lafaurie Sintering Reheviour and Microstructure Development of Indian Reuvite	809
Z-DZ-1Z	Sintering Behaviour and Microstructure Development of Indian Bauxite Himansu Sekhar Tripathi, Manas K Haldar and Arup Ghosh	005
	minimo ookiidi mpanii, manao k madai and mup Onosii	

2-B2-13	Development of Synthetic Dead Burned Magnesia for Monolithic Refractories Raw Material and Synthetic Magnesia Products Application to Environmental Materials	812
	Satoru Yasutake, Akira Yoshida, Katsuhiko Sato and Takashi Nemoto	
2-B2-14	Effects of Various Doping Elements Affecting Synthesis and Characteristics of Al <sub>4</sub> SiC <sub>4</sub> .	816
	Tomohiro Nishikawa, Yasuhiro Hoshiyama and Akira Yamaguchi	
2-B2-15	New Development of Wear Resistant High Alumina Aggregates for Application in Monolithic	000
	Castables (Invited)	820
2 D2 16	Swapan Kumar Das	
2-B2-16	Crystallographic Characterization and Thermal Decomposition Behavior of High-Purity	825
	Microcrystalline Magnesite Zhongyang He, Ma Letian and Baikuan Liu	823
2 B2 17	Formation of High-density Texture of Carbon Containing Refractory by much Addition of	
Z-DZ-1/	Al <sub>4</sub> SiC <sub>4</sub>	829
	Yasuhiro Hoshiyama and Akira Yamaguchi	02)
2-B2-18	Preparation of Micro-porous Cacium Hexaluminate-Spinel Aggregates and the Influence of	
	Calcination Temperature on Properties	833
	Bi Yubao, Zhou Ningsheng, Li Chunming and Yang Xuerui	
2-B2-19	Application and Research of Wet-gunning Based on Colloidal silica for Main trough of Blast Furnace	837
	Chia Hong Chen	
	ience: Mechanical Properties	0.40
2-D-1	Simulation of the Thermomechanical Behaviour of Magnesia-spinel Refractories	840
	Renaud Grasset-Bourdel, Arnaud Alzina, Marc Huger, Thierry Chotard, Dietmar Gruber and	
2-D-2	Harald Harmuth Thermomechanical modelling of a blast furnace hearth	844
Z-D-Z	Alain Gasser, J. Brulin, Amna Rekik, Laurent Josserand, Eric Blond and F. Roulet	044
2-D-3	Eutectic Aggregates Containing Refractory Castables: What are their Effects on Fracture	
2 D 3	Energy and Thermal Shock Damage Resistance?	848
	Dan Yushin Miyaji, Thorsten Tonnesen and José de Anchieta Rodrigues	0.0
2-D-4	Microstructures and Mechanical Properties of Al <sub>2</sub> O <sub>3</sub> -C Refractories with Silicon Additive Using	
	Different Carbon Sources	852
	Haibing Fan, Yawei Li, Shaobai Sang, Shengli Jin, Yuanbing Li and Lei Zhao	
2-D-5	Cracks Extension in Refractories (Invited)	856
	Richardcarl Bradt	
2-D-6	Comparison of different designs of bottom linings with dry joints	864
	Alain Gasser, Jelle Spangenberg Amna Rekik, Eric Blond and Kirill Andreev	0.00
2-D-7	Characterization of the anisotropic grain coarsening in aluminum titanate ceramics	868
	Alexandra Gallet Doncieux, Philippe Michaud, Marc Huger, Thierry Chotard, Nobuo Ishizawa and	
2-D-8	Toshitaka Ota Influence of Firing Temperature on the Properties of Andalusite-Based Bricks	872
Z-D-0	Guotian Ye, Suping Li Quanli Jia, Fuchao Li Jiantao Li and Gengcheng Sun	012
2-D-9	Characterization of porous alumina from platelets	875
	Shinobu Hashimoto, Sawao Honda and Yuji Iwamoto	0,0
	•	
Basic Sc	ience: Thermochemistry	
2-D-12	Molecular Dynamics Study on Sintering Process of Alumina Ceramics	879
	Nozomu Uchida, Riun Kanno and Tomohiro Okada	
2-D-13	Research of Microstructure and Phase Composition of Sialon-bonded Alumina Refractories	000
	Obtained by Reactive Sintering under Various Temperatures	882
	Valeriy Vladlenovich Martynenko, Vladimir Primachenko, Lina Babkina, Ludmila Savina,	
2-D-14	Eleonora Karyakina and Natalya Privalova Sintering of Alumina-Silica High Temperature Materials	886
∠-IJ-1 <del>4</del>	Tadayuki Koumoto, Akira Yamaguchi, Yasuhiro Hosiyama	000
2-D-15	Effect of Iron Oxide in Activated Synthesis & Sintering of Complex Spinel	890
10	Rahul Lodha, Hamidreza Zargar, Carmen Oprea, Tom Troczynski and George Oprea	270
2-D-16	Processing and Properties of Microporous Insulation Materials with Layered Structure	894
	Young-Wook Kim, Jung-Hye Eom, Doo-Hoa Jeong and Seung-Seok Lee	

2-D-17	Thermal Changes of Polycrystalline Wool heated in Hydrogen Atmosphere	898
	Nobuyuki Takeuchi, Masaru Sugiyama and Mikiya Fujii	
2-D-18	Bio-soluble Alkaline Earth Silicate (AES) Wool in High-Temperature Applications	902
0 D 10	Juergen Rank, Volker Krasselt, Volker Uhlig and Dimosthenis Trimis	
2-D-19	Crystallization of Stratlingite in a High Alumina Cement - Silica Fume System with	005
	Deflocculant	905
a D 20	Adriana Borovsky, Makio Ohkawa, Toshio Shinmei, Makoto Iiyama and Chris Parr	000
2-D-20	Amorphous Content in Rod Flame Sprayed Alumina-titania-zirconia Compounds	909
	Tim Kratschmer and Christos G. Aneziris	
Dosio Co	cience: Chemical Reaction	
2-E-1	Interaction between Glass and Refractories -Bubbles as Criteria	913
Z-L:-1	Rolf Weigand	913
2-E-2	Basic Evaluation of Refractories for the Superstructure of Glass Furnace	915
Z-E-Z	Xuqing Xie, Tadao Teraushi and Ying Zhang	913
2-E-3	Effect of Oxygen in Molten Iron on Wettability between Molten Iron and MgAl <sub>2</sub> O <sub>4</sub> Substrate	919
2-E-3	Naotaka Fukami, Tsuyoshi Ichikawa, Nobuya Shinozaki, and Makoto Ishikawa,	717
2-E-4	The Alkali Resistance of Sialon-bonded Corundum Refractories for COREX Melting Gasifier	923
Z-L- <del>-</del>	Jiguang Wu, Wenwu Wang, Zhiming Huang, Fu Li, Yanbin Feng, Jiandong Wang and Xinhua Zhang	123
2-E-5	Influence of Technological Parameters on Carbothermal Reduction and Nitridation of Zircon	927
2-E-3	Renhong Yu, Mengmeng Zhang and Ningsheng Zhou	921
	Remong 1tt, Wengmeng Zhang and Wingsheng Zhou	
Nano-Ei	ngineered Refractories	
2-E-6	Improved Corrosion Resistance of Alumina-Spinel Castables by Colloidal Alumina Additions	931
	Eric Sako, Mariana Braulio, Enno Zinngrebe, Sieger van der Laan and Pandolfelli	
2-E-7	Influence of Nano-MgO on Expansion of Alumina-Spinel Castables	935
	Tianqing Li, Zhongyang He and Qixiu Zuo	
2-E-8	Evaluation of the Role of Nano Chromia on Densification of Magnesia-Chrome Refractories	939
	Rahul Lodha, Hamidreza Zargar, Carmen Oprea, George Oprea and Tom Troczynski	
2-E-9		943
	Mariana Braulio, Guilherme Morbioli, Jorge Gallo, Jorivaldo Medeiros and Victor Pandolfelli	
2-E-10		947
	Smita Satpathy, Arup Kumar Samanta, Sukumar Adak, Priyabrata Panda and Arup Kumar Chattopadhyay	
2-E-11	Effect of Addition of Ultra Fine Titania on Polymorphic Transformation of Coke Oven Silica bricks	951
	Bharati Krushna Panda, Pabitra Sahu, Rabindra Kumar Jha and Jai Narayan Tiwari	
2-E-12	Magnesia-Alumina-Carbon (MAC) bricks for Steel Ladle Metal Line and MgO-C for BOF:	
	Integral Solution with Nanotechnology	955
	Carlos Pagliosa, Luís Rodolfo Bittencourt, Paulo Osório Brant, Adão Campos and Nestor Freire	
2-E-13	Effect of the Carbon Nanofiber Addition on the Mechanical Properties of MgO-C Brick	959
	Yoshinori Matsuo, Masato Tanaka, Jouki Yoshitomi, Seong-Ho Yoon and Jin Miyawaki	
2-E-14	The Effect of Applying Nano Carbon in Carbon Containing Refractories	963
	Jonggeol Baek, DoMoon Choi and YongHan Na	
2-E-15	Effcet of Nano-Material on Alumina-Zirconia-Carbon Refractories	967
	Jayant Kumar Sahu, Anupal Sen, Birendra Prasad, Nilachal Sahoo and Jai Narayan Tiwari	
2-E-16	Nano-Tech. Refractories-8 Technological Philosophy and Evolution of Nano-Tech. Refractories	971
	Shinichi Tamura, Tsunemi Ochiai, Shigeyuki Takanaga, Taka-aki Kanai, Hiroshi Nakamura,	
	Kiyoshi Goto and Seiji Hanagiri	
2-E-17	Nano-Tech. Refractories-9 The Basic Study on the Formation of the Nano Structured Marix in	
	MgO-C Bricks	975
	Osamu Matsuura, Hiroki Yasumitsu, Shigeyuki Takanaga, Masami Hirashima, Tsunemi Ochiai	
	and Shinichi Tamura	
2-E-18	Nano-Tech.Refractories-10 Nano-tech MgO-C Bricks for Converters to Minimize Heat Loss	979
	Masato Tanaka, Hidetoshi Kamio, Jouki Yoshitomi, Tsuneo Kayama, Seiji Hanagiri and Kiyoshi Goto	
2-E-19	Nano-Tech. Refractories-11 The Application of Nano-technology to AG Materials for Sliding	
	Nozzle Plates and Carbon Bricks for Blast Furnaces	983
	Tomohiro Yotabun, Tomohiro Tsuda, Hirokatsu Hattanda and Haruyoshi Tanabe	