# Refereed Proceedings

# The 13th International Conference on Fluidization - New Paradigm in Fluidization Engineering

Engineering Conferences International

Year~2010

# TABLE OF CONTENTS

Sang Done Kim\*

Jea Keun Lee<sup>‡</sup>

Yong Kang<sup>†</sup> Yong Chil Seo\*\*

This paper is posted at ECI Digital Archives.

 $http://dc.engconfintl.org/fluidization\_xiii/3$ 

<sup>\*</sup>Korea Advanced Institute of Science and Technology, Korea

 $<sup>^\</sup>dagger {\rm Chungnam}$ National University, Korea

<sup>&</sup>lt;sup>‡</sup>Pukyong National University, Korea

<sup>\*\*</sup>Yonsei University, Korea

## TABLE OF CONTENTS

PREFACE		٠ ا
LIST OF REV	IEWERSX	Ш
PLENARY LEG	CTURES	
P-1	A PERSPECTIVE ON DEVELOPMENT OF NOVEL FLUIDIZED BED PROCESSES FOR A MORE SUSTAINABLE GLOBAL FUTURE  John R. Grace	1
P-2	A SINGLE PARTICLE VIEW OF FLUIDIZATION  Jonathan Seville	9
P-3	FLUIDIZATION OF NANOPOWDERS: EXPERIMENTS, MODELING, AND APPLICATIONS  J. Ruud van Ommen and Robert Pfeffer	17
P-4	FLUIDIZATION-PAST & FUTURE  Masayuki Horio	25
DENSE FLU	IDIZATION: BUBBLING AND SLUGGING I	
1-1	BUBBLE-FREE FLUIDIZATION OF PARTICLES IN THE VOIDS OF A PACKING OF COARSE SPHERES Brunello Formisani, Rossella Girimonte, Patrizia Bafaro and Vincenzino Vivacqua	33
1-2	PARTICLE CLUSTERS IN FLUIDIZED BEDS Ray Cocco, Frank Shaffer, S.B. Reddy Karri, Roy Hays and Ted Knowlton	11
1-3	GAS AND SOLID MIXING IN A THREE PARTITIONED FLUIDIZED BED Gyoung Tae Jin, Seung-Yong Lee, Young-ju Seo, Solim Kang and Ho-Jung Ryu	19
1-4	INVESTIGATION OF THE SHIFTING-PARAMETER AS A FUNCTION OF PARTICLE SIZE DISTRIBUTION IN A FLUIDIZED BED TRAVERSING FROM A FIXED TO FLUIDIZED BED  C. Rautenbach, M.C. Melaaen and B.M. Halvorsen	57
1-5	MOTION OF A LARGE OBJECT IN A 2D BUBBLING FLUIDIZED BED  A. Soria-Verdugo, L. M. Garcia-Gutiérrez, S. Sánchez-Delgado, and  U. Ruiz-Rivas	
1-6	MULTIPLE ORIFICE BUBBLE GENERATION IN GAS-SOLID FLUIDIZED BEDS: THE ACTIVATION REGION APPROACH S.Sánchez-Delgado, J.V. Briongos, A. Acosta-Iborra and D. Santana	73

1

1-7	PREDICTION AND VALIDATION OF EFFECT OF BED LENGTH ON RTD OF COAL IN A BUBBLING FLUIDIZED BED Zhihong Liu, Masahiro Narukawa, Makoto Takafuji and Toshiyuki SUDA
1-8	PARTICLE ATTRITION MEASUREMENTS USING A JET CUP Ray Cocco, S.B. Reddy Karri, Yeook Arrington, Roy Hays, John Findlay and Ted Knowlton
1-9	MIXING BEHAVIOR AND HYDRODYNAMIC STUDY OF GASSOLID-SOLID FLUIDIZATION SYSTEM: CO-FLUIDIZATION OF FCC AND COARSE PARTICLES Zeeshan Nawaz, Yujian Sun, Yue Chu and Fei Wei
1-10	EFFECTS OF IMPOSED SOLIDS FLUX AND PRESSURE ON GAS BYPASSING IN DEEP FLUIDIZED BEDS OF GROUP A MATERIALS  A. S. Issangya, S. B. Reddy Karri and T. M. Knowlton
MEASUREM	ENT AND INSTRUMENTATION
2-1	COMPARISON OF VARIOUS MEASUREMENT TECHNIQUES FOR CHARACTERIZING THE HYDRODYNAMICS OF GAS-SOLID FLUIDIZED BEDS  Mojgan Abbasi, Nasim Salehi-Nik, Reza Zarghami, Rahmat Sotudeh-Gharebagh and Navid Mostoufi
2-2	UNDERSTANDING CAPTURE EFFICIENCY IN FLUIDIZED BEDS Kok-Seng Lim, Jonian Nikolov and Trevor D. Hadley
2-3	DYNAMIC ELUTRIATION MEASUREMENT IN A CONTINUOUSLY OPERATED BUBBLING FLUIDIZED BED W. de Vos, E. du Toit and W. Nicol
2-4	NUMERICAL INVESTIGATION OF GAS SAMPLING FROM FLUIDIZED BEDS Tingwen Li, Yongmin Zhang, John Grace and Xiaotao Bi
2-5	FIBRE-OPTIC PROBE FOR THE SIMULTANEOUS MEASUREMENT OF GASEOUS SPECIES COMPOSITION AND SOLIDS VOLUME FRACTION  Jean-Philippe Laviolette, Gregory S. Patience and Jamal Chaouki
2-6	MAGNETIC RESONANCE (MR) MEASUREMENTS OF THE MASS FLUX IN GAS-SOLID FLUIDIZED BEDS C.R. Müller, D.J. Holland, A.J. Sederman, L.F. Gladden and J.S. Dennis
2-7	AN ELECTRICAL CAPACITANCE TOMOGRAPHY STUDY OF PRESSURIZED FLUIDIZED BEDS  Niels G. Deen, Willem Godlieb, Sander Gorter and J.A.M. Kuipers
2-8	FAST X-RAY TOMOGRAPHY OF A BUBBLING FLUIDIZED BED

2-9	DIGITAL IMAGE ANALYIS OF BUBBLE FLOW DISTRIBUTION - INFLUENCE OF OPERATIONAL PARAMETERS Johanna Olsson, David Pallarès and Filip Johnsson	177
2-10	GELDART GROUP INDICATION FROM POWDER MEASUREMENTS WITH A ROTATING DRUM INSTRUMENT	
	Emile S. Webster and Clive E Davies1	185
DENSE FLU	IDIZATION: BUBBLING AND SLUGGING II	
3-1	PARTICLE BREAKAGE IN THE CYCLONES OF FLUIDIZED BED SYSTEMS  Anja Püttmann, Marvin Kramp, Andreas Thon, Ernst-Ulrich Hartge	
	and Joachim Werther	193
3-2	STUDY OF SOLIDS ENTRAINMENT INTO ATTRITION JETS IN FLUIDIZED BEDS Francis Codin Prince France Reputit and Josephin McMiller	204
	Feng Li, Cedric Briens, Franco Berruti and Jennifer McMillan	201
3-3	EVALUATION OF THE MINIMUM VELOCITY OF POLYDISPERSE BED FLUIDIZATION COMPOUNDED OF BIOMASS PELLETS AND THEIR MIXTURES WITH FINE PARTICLES OF COAL	
	Zorin Alexander, Isemin Rafail, Viryasov Dmitriy and Kuzmin Sergey 2	209
3-4	PREDICTION OF CATALYST ATTRITION IN AN INDUSTRIAL FLUIDIZED BED PLANT BASED ON LAB SCALE ATTRITION TESTS Andreas Thon, Anja Püttmann, Ernst-Ulrich Hartge, Stefan Heinrich, Joachim Werther, Gegory Patience and Richard Bockrath	217
3-5	THE TRANSPORT DISENGAGEMENT HEIGHT (TDH) IN A BUBBLING FLUIDIZED BED (BFB) Chian W. Chan, Jonathan P.K. Seville and Jan Baeyens	225
		223
3-6	ON THE CHARGE DENSITY OF ENTRAINED FINES  Muammar Omar, Kwang Seok Choi, Xiaotao T. Bi	
	and John R. Grace	233
3-7	AGGLOMERATION DURING FLUIDIZED-BED COMBUSTION OF BIOMASS	
	Teng Haipeng, Li Shiyuan and Lu Qinggang2	241
3-8	INVESTIGATION OF THE EFFECT OF FLUIDIZATION TIME ON ELECTROSTATIC CHARGE GENERATION IN GAS-SOLID FLUIDIZED BEDS	
	Amanda Giffin, Andrew Sowinski and Poupak Mehrani	249
LIQUID AND	THREE-PHASE FLUIDIZATION	
4-1	A STUDY ON DENITRIFICATION IN A FLUIDIZED BED BIOREACTOR	
	K Vimala I Prasanna Lakshmi and Y Pvdi Setty	257

4-2	IMPACT BEHAVIOUR OF PARTICLES WITH LIQUID FILMS: ENERGY DISSIPATION AND STICKING CRITERIA Sergiy Antonyuk, Stefan Heinrich and Stefan Palzer	:65
4-3	PROCESSING OF PURE VEGETABLE OILS IN A CONTINUOUS FCC PILOT PLANT Peter Bielansky, Alexander Reichhold and Christoph Schönberger 2	:73
4-4	HYDRODYNAMIC CHARACTERISTICS OF LIQUID-SOLID FLUIDIZATION OF BINARY MIXTURES IN TAPERED BEDS J S N Murthy, S. Nandana, PhaniKiran S V G R, V Ramesh, V V Basava Rao and T Sankarshana	81
4-5	EFFECTS OF LIQUID SWIRLING ON GAS-TO-LIQUID MASS TRANSFER IN THREE-PHASE FLUIDIZED BEDS Myung-Jae Seo, Hyung Oh Lim, Sung-Mo Son, Yong Jun Cho, Hee-Chul Yang, Yong Kang, Sang-Done Kim, Heon Jung and Ho Tae Lee	:89
4-6	ELECTRICITY GENERATION CHARACTERISTICS OF AN ANAEROBIC FLUIDIZED BED MICROBIAL FUEL CELL Qingjie Guo, Shuju Zhao, Xuyun Wang, Xuehai Yue and Liangyu Hou	:97
NOVEL FLU	IDIZED-BED REACTIORS I	
5-1	A NOVEL CONSTRUCTION OF A LOW-PRESSURE-DROP AIR NOZZLE WORKING WITH A 535MWe CFB BOILER Pawel Mirek, Marcin Klajny, Wojciech Nowak and Janusz Jabłońki 3	:05
5-2	CHEMICAL-LOOPING STEAM METHANE REFORMING FOR HYDROGE PRODUCTION IN A CIRCULATING FLUIDIZED BED REACTOR Kang Seok Go, Young Wook Jeon, Sang Done Kim, and Chu Sik Park	
5-3	DEVELOPMENT OF A CONTINUOUS NANOPARTICLE COATING WITH ELECTROSPRAYING Ellis, N., Yurteri, C. U. and van Ommen, J. R	21
5-4	SPINNING STRAW INTO GOLD: TURNING ACADEMIC PAPERS INTO COMMERCIAL FLUIDIZED BED REACTOR SOLUTIONS Charles O. Bolthrunis, Michael Hagan and Waheed A. Mukaddam 3	29
5-5	THE HOT GAS DESULFURIZATION IN A COMPACT TWO BEDS SYSTEM INTEGRATED WITH COAL GASIFICATION AND FISHER-TROPSCH SYSTEM  Young Cheol Park, Sung-Ho Jo, Seung-Yong Lee and Chang-Keun Yi	37
5-6	REACTION CHARACTERISTICS OF TWO WATER GAS SHIFT CATALYSTS IN A BUBBLING FLUIDIZED BED REACTOR FOR SEWGS PROCESS Howling River Sungarbo, lo Young Cheel Park and Chang-Keun Vierren 3	1/13

5-7	EXPERIMENTAL AND COMPUTATIONAL STUDY ON THE BUBBLE BEHAVIOR IN A 3-D FLUIDIZED BED WITH A VERTICAL-AXIS, ROTATING DISTRIBUTOR  A. Acosta-Iborra, F. Hernández-Jiménez, C. Sobrino and M. de Vega
5-8	A NOVEL CHEMICAL LOOPING COMBUSTION PROCESS: PRESSURE DROP AND SOLID CIRCULATION RATE MODELLING Yazdanpanah Mohammad-Mahdi, Hoteit Ali, Forret Ann, Delebarre Arnaud and Gauthier Thierry
5-9	HYDRODYNAMICS ON CHEMICAL LOOPING COMBUSTION USING MULTIPHASE CFD WITH KINETIC THEORY OF GRANULAR FLOW Jonghwun Jung and Isaac K. Gamwo
CIRCULATIN	IG AND FAST FLUIDIZATION
6-1	THE EFFECTS OF DISTRIBUTOR DESIGN ON THE SOLIDS DISTRIBUTION IN A CFB RISER Jing Xu, Botao Peng, Chao Zhang and Jesse Zhu
6-2	DECAY FACTOR WITH EXPERIMENTAL VARIABLES IN TWO CIRCULATING FLUIDIZED BED (CFB) RISERS Hyun Suk Lee, Jong Hun Lim, Sang Soon Park, Ho Jeong Chae, Soon Yong Jeong and Dong Hyun Lee
6-3	EFFECT OF DISTRIBUTOR DESIGN ON SOLIDS CIRCULATION AND GAS BYPASS IN AN INTERNAL CIRCULATING FLUIDIZED BED REACTOR  Terris T. Yang and Hsiaotao T. Bi
6-4	RADIAL DISTRIBUTION OF PARTICLE CLUSTERS IN A DOWNER REACTOR UNIT  Mohammad Ashraful Islam, Stefan Krol and Hugo I. de Lasa
6-5	FLOW BEHAVIORS IN A HIGH SOLID FLUX CIRCULATING FLUIDIZED BED COMPOSED OF A RISER, A DOWNER AND A BUBBLING FLUIDIZED BED Guoqing Guan, Chihiro Fushimi, Masahiro Ikeda, Yu Nakamura, Atsushi Tsutsumi, Toshiyuki Suda, Masanori Ishizuka, Hiroyuki Hatano, Satoru Matsuda and Yoshizo Suzuki
6-6	CHARACTERIZATION OF TURBULENT REGIME BEHAVIOR IN THE DILUTE ZONE OF A CIRCULATING FLUIDIZED BED RISER Abdelghafour Zaabout, Hervée Bournot, Renée Occelli and Bousselham Kharbouch
6-7	THE INFLUENCE OF PARTICLE ATTRITION ON SORBENT INVENTORY AND PARTICLE SIZE DISTRIBUTION IN AIR-BLOWN CIRCULATING FLUIDIZED BED COMBUSTORS Piero Salatino, Fabio Montagnaro, Fabrizio Scala and Massimo Urciuolo
	and massino urcidor

6-8	CO-COMBUSTION OF KOREAN ANTHRACITE WITH VARIOUS FUELS IN A COMMERCIAL CIRCULATING FLUIDIZED BED BOILER Jong-Min Lee, Dong-Won Kim, Pyeong-Ki Seon and Jae-Sung Kim ······· 431
6-9	THE SOLIDS FLOW IN THE RISER OF A CFB VIEWED BY POSITRON EMISSION PARTICLE TRACKING (PEPT) Chian W. Chan, Jonathan P.K. Seville and Jan Baeyens
NOVEL FLU	IDIZED-BED REACTIORS II
7-1	GAS-SOLID FLUIDIZATION IN A MICROFLUIDIC CHANNEL Fei Wang and Liang-Shih Fan
7-2	NOVEL TWO-INTERCONNECTED FLUIDIZED BED SYSTEM FOR SELECTIVE SOLID CIRCULATION Ho-Jung Ryu, Jaehyeon Park, Dowon Shun and Seung-Yong Lee 455
7-3	MULTIPLE-LOOP CHEMICAL REACTOR DESIGN WITH PRESSURE BALANCE CONSIDERATION Trevor D. Hadley, Ken Chiang, Nick R. Burke and Kok-Seng Lim ········· 463
7-4	AERATION AND MIXING BEHAVIOURS OF BINARY MIXTURES OF NANO-SIZED POWDERS UNDER SOUND VIBRATION P. Ammendola and R. Chirone 471
7-5	EXPERIMENTS AND MODELLING OF MICRO-JET ASSISTED FLUIDIZATION OF NANOPARTICLES J. Ruud van Ommen, David M. King, Alan Weimer, Robert Pfeffer and Berend G.M. van Wachem
7-6	DESIGN OF NEW FLUIDIZED BED REACTORS FOR CVD - PROCESSES  T. Strer, M. Schober and KE. Wirth
7-7	PLASMA-ENHANCED CHEMICAL VAPOUR DEPOSITION ON PARTICLES IN AN ATMOSPHERIC CIRCULATING FLUIDIZED BED  J. Ruud van Ommen, Elena Abadjieva and Yves L.M. Creyghton
7-8	CHALLENGES WITH THE COUPLING OF FLUIDIZED BEDS FOR CHEMICAL LOOPING COMBUSTION  Marvin Kramp, Andreas Thon, Ernst-Ulrich Hartge, Stefan Heinrich and Joachim Werther
7-9	CHARACTERISTICS AND KINETICS OF BIOMASS PYLOLYSIS IN A MICRO FLUIDIZED BED REACTOR Jian Yu, Jianhong Zhu, Qiang Li, Zhengkang Duan, Shiqiu Gao and Guangwen Xu

REACT	OR.	PFR	FOR	ΜΔ	NCE
	$\mathbf{v}$		·		11 <b>1</b> -

8-1	A MODEL ON AN ENTRAINED BED-BUBBLING BED PROCESS FOR CO <sub>2</sub> CAPTURE FROM FLUE GAS Jeong-Hoo Choi, Chang-Keun Yi and Sung-Ho Jo
8-2	CO-GASIFICATION OF COAL AND WOOD IN A DUAL FLUIDIZED BED GASIFIER VARIATION OF FLUIDIZATION CONDITIONS AND LOAD RATIO  Isabella Aigner, Christoph Pfeifer and Hermann Hofbauer
8-3	INVESTIGATION OF CHANGE OF VOLUMETRIC FLOW IN FLUIDIZED-BED REACTORS  Andrés Mahecha-Botero, Franz Haseidl, Alexander Nguyen, Tingwen Li and John R. Grace
8-4	STEAM GASIFICATION OF LOW RANK COAL CHARS IN A THERMOBALANCE REACTOR AND A FLUIDIZED BED REACTOR Byungho Song, Xueyan Zhu, Woongsig Moon and Won Yang543
8-5	INFLUENCE OF PROCESS PARAMETERS ON FLUIDISED BED DRYING OF POWDERED MATERIALS Piero Bareschino, Antonio Marzocchella and Piero Salatino
8-6	HEAVY METAL VAPORIZATION IN FLUIDIZED BED COMBUSTION OF SOLID WASTE AND COAL Q. Falcoz, J. Liu, D. Gauthier, G. Flamant and S. Abanades
8-7	COMBUSTION CHARACTERISTICS AND EMISSION OF HAZARDOUS AIR POLLUTANTS IN COMMERCIAL FLUIDIZED BED COMBUSTORS FOR SEWAGE SLUDGE Ha-Na Jang, Seong-Bum Park, Jeong-Hun Kim and Yong-Chil Seo 567
8-8	ATTRITION OF BED MATERIALS AND FUEL PELLETS FOR FLUIDIZED BED GASIFICATION APPLICATION P. Ammendola, R. Chirone, F. Miccio, G. Ruoppolo and F. Scala 575
8-9	SHEAR-ASSISTED FLUIDIZED BED POWDER-COATING Piero Bareschino, Francesco Pepe and Piero Salatino
HEAT AND	MASS TRANSFER
9-1	NUMERICAL EXPERIMENT ON EFFECT OF SURFACE ROUGHNESS FOR HEAT AND FLOW AROUND TWO CONTACTING PARTICLES  Azri bin Alias, Kuwagi K., Bin Mokhtar M.A., Takami T.  and Horio M
9-2	HEAT TRANSFER TO IMMERSED COOLING TUBES AND PARTICLES IN A FLUIDIZED BED REACTOR Y. Kobavashi, Y. Mori, A. Goto, H.T. Bi and J.R. Grace
	1. Nobayasii, 1. Moli, A. Oolo, 11.1. Di aliu J.N. Olace

9-3	MODELING OF MASS LOSS OF CHAR PARTICLES DURING COMBUSTION AND INTERACTION WITH INERT MATERIAL  Piotr Pelka and Jacek Leszczynski	7
9-4	HEAT RECOVERY FROM MELTED BLAST FURNACE SLAG USING FLUIDIZED BED Tadaaki Shimizu, Daisuke Haga, Go Mikami, Takayuki Takahashi and Kenji Horinouchi	5
9-5	BASIC STUDY FOR COAL MOISTURE CONTROL INTEGRATING PNEUMATIC CLASSIFICATION TECHNIQUE Zhou-en Liu, Yin Wang, Yajun Tian, Yimin Xie, Wenfeng Ji and Guangwen Xu	1
SPOUTED B	EDS AND ROTATING FLUIDIZATION	
10-1	STUDY OF THE MINIMUM SPOUTING VELOCITY IN A DRAFT-TUBE CONICAL SPOUTED BED H. Altzibar, G. Lopez, M. Olazar and J. Bilbao	9
10-2	FILM COATING ONTO COHESIVE FINE PARTICLES BY A NOVEL ROTATING FLUIDIZED BED COATER  Tetsufumi Kondo, Hideya Nakamura, Tomohiro Iwasaki, Satoru Watano and Daisuke Iwamoto	7
10-3	A CONICAL SPOUTED BED REACTOR FOR THE VALORISATION OF WASTE TIRES Gartzen Lopez, Maider Amutio, Gorka Elordi, Maite Artetxe, Haritz Altzibar and Martin Olazar	5
10-4	HYDRODYNAMICS OF A SPOUT-FLUID BED WITH AN ENLARGED COLUMN FOR FINE PARTICLES  Jian Xu, Lei Gong, Xiaojun Bao and Weisheng Wei	3
10-5	BIOMASS GASIFICATION IN ROTATING FLUIDIZED BED  Mania Abdollahi-Neisiani, Christophe Guy and Jamal Chaouki	1
10-6	NUMERICAL AND EXPERIMENTAL STEADY STATE FLOW AND HEAT TRANSFER IN A CONTINUOUS SPOUTED BED  Cezar A. Rosa, José T. Freire and Hamid Arastoopour	9
10-7	PARTICLE SEGREGATION IN TAPERED FLUIDIZED BEDS  T. M. Gernon, M.A. Gilbertson and R.S.J. Sparks	7
REACTOR M	MODELING & SIMULATION I	
11-1	NUMERICAL STUDY OF BUBBLING FLUIDIZED BEDS: INFLUENCE OF IMMERSED TUBES, EXTRACTION METHODS AND AVERAGING PERIODS Matthias Schreiber, Teklay Weldeabzgi Asegehegn and Hans Joachim Krautz	5

11-2	NUMERICAL STUDY OF BUBBLE HYDRODYNAMICS FOR GAS-SOLID FLUIDIZED BEDS WITH AND WITHOUT HORIZONTAL TUBES  Teklay Weldeabzgi Asegehegn and Hans Joachim Krautz
11-3	DIRECT NUMERICAL SIMULATION OF FLUIDIZED BED WITH IMMERSED BOUNDARY METHOD Kuwagi K., Utsunomiya H., Shimoyama Y., Hirano H. and Takami T
11-4	TIME-AVERAGED MODELLING OF CFBS – ANALYSIS OF THE TERMS IN THE MOMENTUM EQUATIONS Sirpa Kallio, Maiju Seppälä and Veikko Taivassalo
11-5	DEM-CFD MODELLING OF A FLUIDIZED BED SPRAY GRANULATOR Lennart Fries, Sergiy Antonyuk, Stefan Heinrich and Stefan Palzer
11-6	CFD SIMULATION OF THE REACTING FLOW PROCESS OF COAL PYROLYSIS TO ACETYLENE IN HYDROGEN PLASMA DOWNER REACTORS Binhang Yan, Changning Wu, Yong Jin and Yi Cheng
11-7	CFD-DEM SIMULATION OF SYNGAS-TO-METHANE PROCESS IN A FLUIDIZED-BED REACTOR Changning Wu, Dayong Tian and Yi Cheng733
11-8	CFD SIMULATION OF A LIQUID-FLUIDIZED BED OF BINARY PARTICLES Long Fan, John R. Grace and Norman Epstein
11-9	COMPUTATIONAL STUDY OF LAYER INVERSION IN TWO-COMPONENT LIQUID-FLUIDIZED BEDS BY DEM-CFD Alberto Di Renzo, Fernando Cello and Francesco Paolo Di Maio
REACTOR P	PERFORMANCE II
12-1	THE EFFECT OF GAS TEMPERATURE AND VELOCITY ON COAL DRYING IN FLUIDIZED BED DRYER  Jae hyeon Park, Dowon Shun, Dal-Hee Bae, Sihyun Lee,  Jeong Hak Seo and Jae Hyeok Park
12-2	PERFORMANCE COMPARISON OF SYNGAS METHANATION ON FLUIDIZED AND FIXED BED REACTORS  Yingli Wang, Jiao Liu, Qiang Li, Jian Yu, Fabing Su and Guangwen Xu
12-3	FLUIDIZATION TECHNOLOGY FOR STABLE STARTUP OF COMMERCIAL FCC UNIT Sung Won Kim, Gyung Rok Kim, Jae Wook Shin, Ik Sang Yoo, Hun Sik Kang and Sang Hoon Park

12-4	ONE-DIMENSIONAL MODELING OF OXY-FUEL FLUIDIZED BED COMBUSTION FOR CO₂ CAPTURE Sadegh Seddighi, David Pallarès and Filip Johnsson
12-5	FLUIDIZED BED COMBUSTION OF C1-C4N-ALKANES  Jean-Philippe Laviolette, Gregory S. Patience and Jamal Chaouki
12-6	SYNGAS PRODUCTION WITH A DUAL FLUIDIZED BED GASIFIER FOR POLYGENERATION Uen Do Lee, Young Doo Kim, Hyo Jae Jeong, In Soo Choi, Yeon Kyung Sung, Tae U Yoo and Jae Hun Song
12-7	FLUIDIZED BED GASIFICATION OF BIOMASS: A SUBSTANCE FLOW ANALYSIS Umberto Arena, Fabrizio Di Gregorio, Lucio Zaccariello and M. Laura Mastellone 805
12-8	HIGH PERFORMANCE COMPUTING: CLEAN COAL GASIFIER DESIGNS USING HYBRID PARALLELIZATION  M Syamlal, C Guenther, A Gel and S Pannala 813
12-9	TAILORED SYNTHESIS OF PRECIPITATED MAGNESIUM CARBONATES AS CARBON-NEUTRAL FILLER MATERIALS DURING CARBON MINERAL SEQUESTRATION Huangjing Zhao, Nathan Dadap and Ah-Hyung Alissa Park
REACTOR N	MODELING & SIMULATION II
13-1	MODELING OF THE SOLIDS INVENTORY IN CFB BOILERS David Pallarès, Filip Johnsson and Marko Palonen 829
13-2	TOWARDS A THEORETICAL MODEL OF SEGREGATING FLUIDIZATION OF TWO-SOLID BEDS Brunello Formisani, Rossella Girimonte and Vincenzino Vivacqua
13-3	ZERO-DIMENSIONAL MODELING OF INDIRECT FLUIDIZED BED GASIFICATION Anton Larsson, David Pallarés, Daniel Neves, Martin Seemann and Henrik Thunman
13-4	CFD SIMULATION OF PHARMACEUTICAL PARTICLE DRYING IN A BUBBLING FLUIDIZED BED REACTOR  Jungkee Jang, Cezar Rosa and Hamid Arastoopour 853
NON-CONVE	ENTIONAL FLUIDIZED BEDS
14-1	HYDRODYNAMICS OF UNCONVENTIONAL FLUIDIZED BEDS: SOLIDS FLOW PATTERNS AND THEIR INFLUENCE ON MIXING/SEGREGATION OF A LARGE FLOTSAM PARTICLE IN ABED OF FINER SOLIDS Roberto Solimene, Paola Ammendola, Giovanna Ruoppolo and Riccardo, Chirone 861

### Kim et al.: TABLE OF CONTENTS

ΧI

14-2	EVALUATION OF FLUID DYNAMICS IN A HOT AND A COLD SYSTEM OF INTERCONNECTING FLUIDISED BEDS Fredrik Lind, Martin Seemann and Henrik Thunman
14-3	DEM FLUIDIZATION OF SMART PARTICLES Amit Suri and Masayuki Horio 877
14-4	EXPERIMENTAL QUANTIFICATION OF THE SOLIDS FLUX IN AN INTERNALLY CIRCULATING FLUIDIZED BED Trevor D. Hadley, Christian Doblin, José Orellana and Kok-Seng Lim
14-5	PENETRATION OF HIGH VELOCITY HORIZONTAL GAS JETS INTO A FLUIDIZED BED AT HIGH TEMPERATURE Feng Li, Cedric Briens, Franco Berruti and Jennifer Mc Millan
14-6	INVESTIGATION OF REFORMING ACTIVITY AND OXYGEN TRANSFER OF OLIVINE IN A DUAL CIRCULATING FLUIDISED BED SYSTEM WITH REGARD TO BIOMASS GASIFICATION Stefan Koppatz, Tobias Pröll, Christoph Pfeifer and Hermann Hofbauer
SUBJECT IND	EX
AUTHOR INDI	<b>=X</b> ······· 913

The 13th International Conference on Fluidization - New Paradigm in Fluidization Engineering, Art. 3 [2010]  $$\operatorname{\sf XII}$$