

# **Liaison Functions 2013**

**Core Programming Area at the 2013 AIChE Annual Meeting:  
Global Challenges for Engineering a Sustainable Future**

**San Francisco, California, USA  
3 – 8 November 2013**

**ISBN: 978-1-63439-044-6**

**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© (2013) by AIChE  
All rights reserved.

Printed by Curran Associates, Inc. (2014)

For permission requests, please contact AIChE  
at the address below.

AIChE  
3 Park Avenue  
New York, NY 10016-5991

Phone: (203) 702-7660  
Fax: (203) 775-5177

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

## TABLE OF CONTENTS

<b>(19a) AIChE 101 .....</b>	1
<i>Katherine J. Gawel, Meagan Lewis</i>	
<b>(19b) Navigating the AIChE Annual Conference .....</b>	2
<i>Katherine J. Gawel, Meagan Lewis</i>	
<b>(59a) Sustainability Metrics For Biofuel Production Process Design .....</b>	3
<i>Abigail S. Engelberth, Nathan Mosier</i>	
<b>(59b) Novel Framework To Examine Sustainability Of Biorefining Processes .....</b>	4
<i>Sumesh Sukumara, Dr. Jeffrey Seay</i>	
<b>(59c) Case Studies For Sustainable Process Development In Biotechnology and Engineering Industry .....</b>	5
<i>Norman E. Sammons</i>	
<b>(71a) I'm a Chemical Engineer. Why Should I Become a PE? .....</b>	6
<i>William R. Parrish, Cory D. Jensen</i>	
<b>(71b) Fundamentals of Engineering Examination and Enhancing Student Performance .....</b>	7
<i>Robert W. Peters, Jason T. Kirby, Ian Hosch</i>	
<b>(71c) The New Computer-Based FE Exam for Chemical Engineers .....</b>	8
<i>Davy McDowell</i>	
<b>(71d) Licensure – An Academic Perspective .....</b>	9
<i>S. Ranil Wickramasinghe, Thomas O. Spicer</i>	
<b>(71e) Use of the Fundamentals of Engineering Exam As An Engineering Education Assessment Tool .....</b>	10
<i>David A. Rockstraw</i>	
<b>(85a) An Example Of Success Achieved With The Collaboration Mexico - Canada: A Scientific Project Sponsored By Conacyt – Mexico and Its IMPACT On Students .....</b>	11
<i>Benito Serrano, Hugo I. De Lasa, Jesus Moreira, Jose Luis Vazquez, Mario Alberto Hernandez, Sarai Guevara, Sergio Garcia Bermudez</i>	
<b>(85b) Dynamic Design of a Cryogenic Air Separation Unit .....</b>	14
<i>Samantha Schmidt, Russell Clayton</i>	
<b>(85c) Navigating the Natural Gas Boom: Policy Option for Ensuring a Safe, Clean, and Economical Natural Gas Revolution .....</b>	15
<i>Andrew Crothers, Philip Winkler</i>	
<b>(85d) A Wavelength Shifting Polymer to Enhance the Growth and Production of Cyanobacteria .....</b>	16
<i>Trent Nelson, David R. Salem, Robb M. Winter</i>	
<b>(85e) Exploring Multiphase Viscous Drop Impact With a Bulk Fluid .....</b>	17
<i>Alison N. Logia, Travis W. Walker, Gerald G. Fuller</i>	
<b>(85f) Designing Copper Zinc Oxide as a P-Type Transparent Conducting Oxide for Photovoltaic Applications .....</b>	18
<i>Daniel Sun</i>	
<b>(104a) Use Vesicle Membrane As a Designable Platform for Molecular Recognition ~ Toward Creation of Bio-Inspired Chemical Engineering Based On Membranome ~ .....</b>	19
<i>Hiroshi Umakoshi, Keishi Suga</i>	
<b>(104b) Morphological Transitions in Block Copolymers Directed By Superparamagnetic Nanoparticles .....</b>	20
<i>Vinay Raman, Bradley D. Olsen, T. Alan Hatton</i>	
<b>(104c) Design of Autonomously Moving Colloidal Objects – Systematic Motion of Vesicles, Particles and Oil/Water Interface in a Homogenous Chemical Field – .....</b>	21
<i>Akihisa Shioi</i>	
<b>(104d) Development and Properties of Novel Photo-Cleavable Surfactants .....</b>	22
<i>Hideki Sakai, Shohei Aikawa, Kaori Fukuda, Rekha Shrestha, Takeshi Endo, Kenichi Sakai, Masahiko Abe</i>	
<b>(104e) Ordering Transitions Triggered By Specific Binding of Vesicles to Protein-Decorated Interfaces of Thermotropic Liquid Crystals .....</b>	23
<i>Nicholas L. Abbott, Lie Na Tan</i>	
<b>(104f) Directed Aggregation and Fusion of Vesicles Induced By a DNA-Surfactant .....</b>	24
<i>Masahiro Goto</i>	
<b>(150a) Race To 2015: The Completion Of The Millennium Development Water, Sanitation, and Hygiene Goal .....</b>	25
<i>Christina Delago</i>	
<b>(150b) Dynamic Design of a Ethylamine Production Plant .....</b>	26
<i>Kristen Becht, Alexandria Wiedorn</i>	
<b>(150c) Acetic Acid and Methanol Recovery Unit .....</b>	28
<i>Victoria F. Berard, Alessandra Dinardo, Seth Fortney</i>	
<b>(150d) A Re-Examination of US Water Policies That Prevent Sustainable Water Consumption and Reuse .....</b>	29
<i>Nick Kusanto</i>	
<b>(150e) Toluenediamine Production Through Hydrogenation in Methanol Solvent .....</b>	31
<i>Rebecca Masel, Dalton Smith</i>	
<b>(150f) Experimentation: The Foundation of Career Growth .....</b>	32
<i>Jonathan H. Worstell, Jessica Orsak, Jacob Arredondo</i>	
<b>(150g) Using Molecular Simulation to Improve the Efficiency of Biomass Processing .....</b>	33
<i>Zack Jarin</i>	

(210a) Rapid Skin Permeabilization By The Simultaneous Application Of Dual-Frequency Ultrasound.....	34
Rudy Maa	
(210b) N/a .....	35
Josh Zeidman	
(210c) A Novel Formulation For Non-Swelling Peg Hydrogels For Application In Spinal Cord Injury (SCI).....	36
Michael Fu	
(210d) The Quantification Of Mitochondrial Location and Morphology Using Matlab.....	37
Blakely Bussie, Petra Kerscher, Elizabeth A. Lipke	
(210e) Analysis Of CELL Proliferation Within A 3D Tissue-Engineered Cancer MODEL.....	38
Jacob Clary, Shantanu Pradhan, Elizabeth A. Lipke	
(210f) Membrane Compatibility With Switchable Polarity Draw Solutions For Use In Forward Osmosis Applications.....	39
Benjamin J. Coscia, Kevin K. Reimund, Aaron D. Wilson, Jeffrey R. McCutcheon	
<b>Force to Death and New Life, Some with Programming Vitality .....</b>	40
Eleftherios T. Papoutsakis	
(248a) Synthesis of Fine Chemicals by Heterogeneous Catalysis: A Critical Approach of the Role of Solvent for Hydrogenation Reactions.....	41
Carlos Apestegua	
(267b) Career Development: It Ain't A Random Walk .....	42
Jonathan H. Worstell	
(267a) An Industry Career in Process Development: Leveraging Chemical Engineering Training.....	43
Joseph B. Powell	
(267d) Chance Favors The Prepared Mind .....	44
Michael Hill	
(281a) At Least 1,000X Thinner than a Human Hair.....	45
Brian A. Korgel	
(335a) Pot Growth Of Sweet Corn On Acidic Soil Ameliorated By a Modified Waste Mud In Guangdong Province, P R China .....	46
Lin Shi	
(335b) The Photocatalytic Activity Of ZnO/ZnS Core/Shell Particles For Methyl Orange .....	47
Wenjiang Li	
(335c) Biosynthesis of Polyhydroxybutyrate By Thermotolerant Chelatococcus Daeguensis Strain TAD1 At Elevated Temperatures: A Potential Low-Cost Way for Large-Scale Production .....	48
Shaobin Huang	
(335d) Effects Of Phenol On The Degradation Of Reactive Brilliant Blue Kn-R In SR-AOP .....	49
Yongwen Ma	
(335e) Effects Of Oxygen Plasma Pretreatment Of Mwents In MnOx/Mwents Catalyst For Selective Catalytic Reduction Of NO .....	50
Bichun Huang	
(335f) Adsorption and Photodegradation Of Dimethyl Phthalate In An Aqueous Solution By TiO2/ Hydrotalcite Composites .....	51
Pingxiao Wu	
(335g) Comprehensive Utilization of Selenium Resources in Black Shales of Enshi .....	53
Qin Shuai	
(335h) Imbibition Oil Recovery Theory and Influencing Factors.....	54
Yi Zhang	
(335i) Developing the Green Chemistry Principles.....	55
Weiquan Cai	
(335j) Synthesis Technics of Aliphatic Dicarboxylic Acid Alkoxy Ethyl Ester .....	56
Muhua Chen	
(335k) Research On the Performance of SCR of NOx of Loaded Catalysts With Activated Carbon As Carrier.....	58
Keting Gui	
(335l) Determining Stoichiometry in p-Cresol/Tert-Butanoland p-Cresol/ Piperazinehydrogen Bondcomplexesusing Raman Spectroscopy and DFT Calculation .....	59
Min Huang	
(335m) Development of Inorganic Membranes in China - Present and Future .....	60
Wanqin Jin	
(335n) Diversity of Glycyrrhizin Biotransformation By $\beta$ -Glucuronidases From Fungi .....	61
Chun Li	
(335o) Chemical-Looping Cumbustion of Methane Using Fe2O3-Based Oxygen Carriers With a Thermal Storage Function.....	62
Kongzhai Li	
(335p) Green Technical Routes and Clean Productions for Diene-Based High Performance Elatomers .....	63
Qinmin Pan	
(335q) Extraction of Fir Wood Oil From Fir Wood Waste and Synthesis of Cedar Series Perfumes.....	64
Kai Zhu	
(335r) High-Efficiency Synthesis of Cyclic Carbonates From Epoxides and CO2 Over Immobilized Hydroxyl Ionic Liquid Catalyst .....	65
Shuangfeng Yin	

<b>(342a) Immobilization of Recombinant Antibody Fragment Utilizing Material-Binding Peptides for Sensitive Immunoassay and Immuno-Sensors .....</b>	66
<i>Yoichi Kumada, Michimasa Kishimoto</i>	
<b>(342b) Biomagnetic Nanomaterials for High Gradient Magnetic Affinity Separation.....</b>	67
<i>Gil U. Lee, Conor Fields, James O'Mahony, Victoria Matias, Peng Li, Loraine Smith, Julien Muzard</i>	
<b>(342c) Theoretical Investigations of Multiple Weak Interactions in Multimodal Chromatography Using Molecular Dynamics Simulations and Protein Surface Characterization .....</b>	68
<i>Siddharth Parimal, James A. Woo, Kartik Srinivasan, Melissa A. Holstein, Shekhar Garde, Steven M. Cramer</i>	
<b>(342d) Development of Adsorptive Membranes With Glycoligands for Targeted Lectin Binding.....</b>	70
<i>Heather C. S. Chenette, Scott M. Husson</i>	
<b>(342e) Overload and Elute Chromatography for Enhanced MAb Purification.....</b>	71
<i>Deepa Nadarajah, Stephen Hohwald, Debola Banerjee, Kevin Shomglin, Rick St. John, Amit Mehta</i>	
<b>(342f) Development of Production Method for Zeaxanthin By Fermentation Using <i>Paracoccus carotinifaciens</i> .....</b>	72
<i>Hidetada Nagai</i>	
<b>(342g) Molecular and Pore Diffusion Coefficients of DNAs and Modified Proteins for Process Chromatography .....</b>	73
<i>Syohei Ohshima, Noriko Yoshimoto, Shuichi Yamamoto</i>	
<b>(374a) Simulation Tools for Nanoparticle-Based Composite Processing and Property Prediction .....</b>	74
<i>Dan S. Bolintineanu, Jeremy B. Lechman, P. Randall Schunk</i>	
<b>(374b) Tin Oxide Nanowires and Their Hybrid Architectures for Kinetically Fast Redox Couples in Dye-Sensitized Solar Cells .....</b>	75
<i>Venkat Kalyan Vendra, Tu Nguyen, Thad Druffel, Mahendra Sunkara, Delaina A. Amos</i>	
<b>(374c) Multiscale Sustainability Assessment in Nanocoating Material Design and Manufacturing.....</b>	76
<i>Hao Song, Rohan Uttarwar, Yinnun Huang</i>	
<b>(374d) Continuous Nanoparticle Sizing and Characterization Via Microfluidic Interfacial Fluorescent Complexation .....</b>	77
<i>Fanxu Meng, Victor M. Ugaz</i>	
<b>(374e) Safer Formulation Concept for Flame-Generated Engineered Nanomaterials.....</b>	78
<i>Georgios A. Sotiriou, Samuel Gass, Joel Cohen, Georgios Pyrgiotakis, Soitiris E. Pratsinis, Philip Demokritou</i>	
<b>(374f) Green Pathways for Development of Nanostructured Aerogel Photocatalysts Effective At Both UV and Visible Range.....</b>	80
<i>Haitao Li, Sermin G. Sunol, Aydin K Sunol</i>	
<b>Engineering Cell Niches in a Couple of Clicks .....</b>	81
<i>Kristi S. Anseth</i>	
<b>(459a) Theory and Computation in Modern Chemical Engineering. A Thermodynamicist's Perspective .....</b>	82
<i>Pablo G. Debenedetti</i>	
<b>(461a) US Department Of Energy Critical Materials Strategy and R&amp;D .....</b>	83
<i>Michael McKittrick</i>	
<b>(461b) Research Gaps and Needs: Critical Materials Separations R&amp;D Workshop.....</b>	84
<i>Darlene Schuster, Catherine T. Hunt, Kristine Chin, Mamadou Diallo</i>	
<b>(461c) The Availability Of Indium and Tellurium For Thin-Film Photovoltaic Materials .....</b>	85
<i>Roderick Eggert, Martin Lokanc, Michael Redlinger</i>	
<b>(461d) Rare Earth Concentration, Extraction, Separation and Reduction .....</b>	86
<i>Coby Anderson</i>	
<b>(461e) Critical Materials Recycling &amp; Substitutes For Critical Materials.....</b>	87
<i>Edwin Jones</i>	
<b>(461f) Critical Materials Recycling For Resource Sustainability.....</b>	88
<i>Brajendra Mishra</i>	
<b>(478a) Enhanced Yield of Bio-Gas Production With Modified Themo-Reactor Configuration and Separation of CO<sub>2</sub> .....</b>	89
<i>Muhammad Suleman Tahir, Mahmood Saleem</i>	
<b>(478b) Microwave-Assisted Catalytic Glycolysis of Poly(ethylene terephthalate) By Using Ionic Liquids.....</b>	90
<i>Yuting Liu, Yanjun Xing</i>	
<b>(478c) Degradation of Rhodamine-B By Heteropolyoxometalate Ionic Liquid Under Visible Light .....</b>	91
<i>Yuting Liu, Yanan Chen, Yanjun Xing</i>	
<b>(478d) Metal-Containing Ionic Liquid As An Effective Catalyst for the Degradation of Poly(ethylene terephthalate) in Ethylene Glycol .....</b>	92
<i>Xingmei Lu, Qian Wang, Suojiang Zhang</i>	
<b>(478e) Anaerobic Digestion Technology:The Energy,Environment and Health of Developing Nations .....</b>	93
<i>Oluwemi Adetuke</i>	
<b>(478f) Phosphorus Recovery From Municipal Wastewater Treatment Sludge .....</b>	94
<i>Kamal Lamichhane Upadhyaya, W. Todd French, Rafael Hernandez</i>	
<b>(478g) Techno- Economic Analysis of Wastewater Biosolids Gasification .....</b>	95
<i>Nicholas P. G. Lumley, Jason M. Porter</i>	
<b>(513a) Educational Needs in Particle Technology.....</b>	96
<i>Karl Jacob</i>	
<b>(513b) Teaching Mixing to Undergraduate Chemical Engineers.....</b>	97
<i>Richard K. Grenville</i>	
<b>(513c) Addressing Educational Gaps for Process Safety in Both Academia and Industry .....</b>	98
<i>Bruce K. Vaughn</i>	

<b>(513d) Engineering Risk Roundtable .....</b>	99
<i>Diana Matonis</i>	
<b>(513e) Training Chemical Engineers for a Career in Process Development.....</b>	100
<i>William Hollar</i>	
<b>(513f) Responding to the Needs of Industry: Perspectives From the Education Division.....</b>	101
<i>Fred Justice</i>	
<b>(513g) Responding to the Needs of Industry: Nuclear Engineering Division .....</b>	102
<i>John Olson</i>	
<b>(513h) Responding to the Needs of Industry: Sustainable Energy Forum.....</b>	103
<i>Peter Knox</i>	
<b>(513i) Panel Discussion: Responding To Industry's Needs .....</b>	104
<i>Nemoy Rau, Donald P. Visco</i>	
<b>(521a) Characterization of Bio-Oil, Bio-Char from Biomass Fast Pyrolysis and Bio-Char Application into Soil.....</b>	105
<i>Yan Wang, Ronghou Liu, Rinzhan Yin, Lijuan Wu</i>	
<b>(521b) Process Development and Optimization of Cellulosic Derived Sugars from Biomass for Biofuels and Chemicals Applications.....</b>	106
<i>Sarad Parekh</i>	
<b>(521c) Enzymatic Hydrolysis of Old Corrugated Cardboard (OCC) Fines from Recycled Linerboard Mill Waste Rejects.....</b>	107
<i>Byeoung Cheol Min, Bhavin Bhayani, Bandaru V. Ramarao</i>	
<b>(521d) Effects of Fuel Properties on Natural Downward Smoldering of Piled Biomass Powder: Experimental Investigation.....</b>	108
<i>Fang He, Zhenqiang Gao, Bin Luo, Zhihe Li, Weiming Yi</i>	
<b>(521e) Experimental Study of Bio-oil Production from Corn Stalk Using a Fluidized Bed under Hot Flue Atmosphere .....</b>	110
<i>Zhihe Li, Weisheng Niu, Weiming Yi, Yongjun Li, Peng Fu, Deli Zhang, Jing Wang, Xueyuan Bai</i>	
<b>(521f) Quantum Chemistry Study on Adsorption of Gases from Biomass Pyrolysis on CaO Surface.....</b>	112
<i>Baofeng Zhao, Xiaodong Zhang, Lei Chen, Xiaolu Yi, Yongchun Tian, Guanyi Chen</i>	
<b>(534a) Plate Food Waste: A Valuable Source of Energy .....</b>	113
<i>Stephanie Jung</i>	
<b>(534b) Biofuel Production and Kinetics Study of Catalytic Microwave Pyrolysis of Douglas Fir Pellet Over Activated Carbon Supported Metal Catalyst .....</b>	114
<i>Quan Bu, Hanwu Lei, Lu Wang, Juming Tang</i>	
<b>(534c) Molecular-Level Modeling of Municipal Solid Waste Gasification .....</b>	115
<i>Scott R. Horton, Yu Zhang, Craig A. Bennett, Michael T. Klein, Frank Petrocelli</i>	
<b>(534d) Performance Analysis of Rdf Gasification in a Two Stage Fluid Bed - Plasma Process .....</b>	117
<i>Massimiliano Materazzi, Paola Lettieri, Chris Chapman, Richard Taylor</i>	
<b>(534e) Process Modeling of Continuous Catalytic Gasification As a Waste to Energy Alternative.....</b>	121
<i>Charles F. Tillie, Melissa J. Riedthaler, Stephen A. Reeves, Shreya Adhikari, Jorge E. Gatica</i>	
<b>(534f) Performance Evaluation of Accelerated Carbonation of Basic Oxygen Furnace Slag Via a Rotating Packed Bed: Modeling, Analysis and Maximization .....</b>	122
<i>Shu-Yuan Pan, Pen-Chi Chiang, Yi-Hung Chen, E-E Chang, Chung-Sung Tan</i>	
<b>(534g) Production of Alumina From Fly Ash By a Mild and Cleaner Hydrometallurgical Process .....</b>	123
<i>Li Zhong, Dongping Duan, E Zhou, Hongliang Han</i>	
<b>(550a) Polymer Reaction Engineering .....</b>	124
<i>Kyu Yong Choi</i>	
<b>(550b) Crystallization Technology Using Taylor Vortex Fluid Motion.....</b>	125
<i>Woo-Sik Kim</i>	
<b>(550c) Towards Sustainable Energy: Novel Liquid-like Organic Hybrid Nanomaterials for CO2 Capture and Conversion.....</b>	126
<i>Ah-Hyung Alissa Park</i>	
<b>(550d) Panel: Looking Ahead in Developing Academic or Industrial Career .....</b>	127
<i>Yong L. Joo, Kyu Yong Choi, Il Moon, Jaehun Chun, Joon Soo Lee</i>	
<b>(550e) Award Ceremony .....</b>	128
<i>Seong H. Kim</i>	
<b>(550f) Nanobiofabrication: Exploiting Programmable Properties of Biological Materials and Interactions for Fabrication of Nanocatalysts and Biosensing Platforms .....</b>	129
<i>Hyunmin Yi</i>	
<b>(823a) Strategic Imperatives for the Hydrocarbon Industries .....</b>	130
<i>Rajeev Gautam</i>	
<b>(624a) Carbon Nanomaterial Dense Layer Formation On Graphite Particles for Li-Ion Battery Anode By Using Colloidal and CVD Combined Process .....</b>	131
<i>Hidehiro Kamiya, Yosuke Nomura, Motoyuki Iijima, Ilya V. Anoshkin, Albert G. Nasibul, Esko Kauppinen</i>	
<b>(624b) Insertion and Immobilization of Pre-Synthesized Particles Into Sub-100 Nm Porous Structures By Electrophoresis .....</b>	132
<i>K. Kusdianto, K. Sasaki, Wuled Lenggoro</i>	
<b>(624c) Development Of a Novel Rotating Fluidized Bed For Fine Particle Processing .....</b>	133
<i>Satoru Watano, Hideya Nakamura</i>	

<b>(624d) Numerical and Experimental Study of the Correlation Between Bulk Stresses and Interparticle Force in the Biomass Combustion Ash</b>	.....	134
<i>Hidehiro Kamiya, Zhenbo Tong</i>		
<b>(624e) Hydrodynamic Behaviors of Sand and Plastic Particles in a Large-Scale Triple Bed Combined Circulating Fluidized Bed</b>	.....	135
<i>Chihiro Fushimi, Masanori Ishizuka, Guoqing Guan, Yoshizo Suzuki, Koyo Norinaga, Jun-Ichiro Hayashi, Atsushi Tsutsumi</i>		
<b>(624f) Microscopic Numerical Investigation of Dense Gas-Solid Flows Near a Solid Wall (Effects of Wall on the Behavior of Particles)</b>	.....	136
<i>Shinobu Fujihara, Takuya Tsuji, Toshitsugu Tanaka</i>		
<b>(624g) Drag Force Relation By Direct Numerical Simulation for Gas-Solid Flows</b>	.....	137
<i>Ali Zaidi, Takuya Tsuji, Toshitsugu Tanaka</i>		
<b>(648a) Background on NuClean Initiative</b>	.....	138
<i>Beth Beloff, Richard V. Calabrese, Vasilios Manousiouthakis, Stuart T. Arm</i>		
<b>(648b) Overview: Nuclear waste management - Technical, Political, Regulatory Challenges regarding Commercial and Legacy Waste</b>	.....	140
<i>Mark Gilbertson, David Kosson</i>		
<b>(648c) Assessment and Perception of Risks Associated with Nuclear Waste</b>	.....	141
<i>Edwin Jones, Michael Greenberg, Chris G. Whipple, Marian Naranjo</i>		
<b>(649a) Clicking Polymers Together: Assembly of Complex, Controlled Polymer Structures from Efficient Chemistries</b>	.....	142
<i>Christopher N. Bowman</i>		
<b>Author Index</b>	.....	