



# 5<sup>th</sup> Advances in Cement-based Materials:

Characterization, Processing, Modeling and Sensing

July 9-11, 2014 | Tennessee Technological University | Cookeville, Tennessee

## WEDNESDAY, JULY 9, 2014

Noon – 6:00 pm	<b>Registration</b> <b>Ray Morris Hall</b> , STEM Center Lobby
1:00 - 1:15 pm	<b>Welcome to the Workshop</b> , STEM Center Auditorium
1:15 - 2:15 pm	<b>Overview of ORNL Facilities</b> , STEM Center Auditorium Michelle Buchanan
2:15 - 2:30 pm	<b>BREAK</b> , STEM Center Lobby
2:30 - 3:30 pm	<b>Cement and Concrete Research at ORNL Related to Nuclear Applications</b> , STEM Center Auditorium James Hemrick, Yann Le Pape and Catherine Mattus
3:30 - 5:30 pm	<b>Poster Session</b> , STEM Center Lobby
5:00 - 6:00 pm	<b>Cements Division Executive Meeting</b>
6:30 - 9:00 pm	<b>Student Networking Dinner, Crawdaddy's Grill</b> 53 West Broad Street, Cookeville

## THURSDAY, JULY 10, 2014

8:00 – 8:15 am	<b>Welcome</b> , STEM Center Auditorium
<b>Session 1   ADMIXTURES I   8:15 – 9:30 am</b>	
8:15 – 8:30 am	<b><i>Durability and Engineering Performance of Calcium-Silicate-Hydrate Systems Modified with Nitro-Benzoic Acid</i></b> Rahil Khoshnazar, James Beaudoin, Laila Raki and Rouhollah Alizadeh
8:30 – 8:45 am	<b><i>Multi-Modeling Approach to Study the Effectiveness of Grinding Aids</i></b> Ratan Mishra, Heinz Hendrik, Falk Wittel, Hans Herrmann, Humberto Carmona, Mark Sawley, David Geissbuhler, Martin Weibel, Emmanuel Gallucci and Robert J. Flatt
8:45 – 9:00 am	<b><i>Influence of the Addition Time of Superplasticizer on the Rheological Properties of Self-Consolidating Cement Paste</i></b> Azadeh Asghari, Dimitri Feys and Geert De Schutter
9:00 – 9:15 am	<b><i>Stability of Entrained Air in Self-Consolidating Concrete Under Vibration</i></b> Daniel Castaneda, Jeremy Koch, Randy Ewoldt, Kyle Riding and David Lange
9:15 – 9:30 am	<b><i>Micellization and Adsorption of Air-Entraining Agents</i></b> Lori Tunstall and George Scherer
9:30 – 10:00 am	<b>BREAK</b> , STEM Center Lobby
<b>Session 2   ADMIXTURES II   10:00 – 10:45 am</b>	
10:00 – 10:15 am	<b><i>Dissolution of Synthetic Fly Ash Glass in Simulated Cement Pore Water Solution</i></b> Walairat Bumrongjaroen, Kiatsuda Somna, Richard Livingston and Isabelle Muller
10:15 – 10:30 am	<b><i>Using Air-Cooled Blast Furnace Slag as Coarse Aggregate in Pavement Concrete</i></b> Kho Verian, Parth Panchmatia and Jan Olek

10:30 – 10:45 am	<b><i>Geochemical Modeling to Predict Long-Term Material Performance of Concrete Materials with Fly Ash Replacement Under Carbonation Attack</i></b> Janelle Branch, Kevin Brown, Josh Arnold, Hans van der Sloot and David Kosson
<b>Session 3   ALTERNATIVE CEMENTS   10:45 – 11:30 am</b>	
10:45 – 11:00 am	<b><i>Preparation and Characterization of Novel Compositions with Real World Implications to Support the Modeling Effort to Assess Long Term Performance for the Disposition of Low Activity Radioactive Waste</i></b> Alex Cozzi, David Swanberg and Joseph Westsik
11:00 – 11:15 am	<b><i>Numerical Investigation of Class H Cement Deterioration Under CO<sub>2</sub>-O<sub>2</sub> Co-Exposure in High Temperature and High Pressure Down-Well Conditions</i></b> Vahid Jafari Azad, Chang Li, David Esteban Rodriguez, Jason Ideker and O. Burkan Isgor
11:15 – 11:30 am	<b><i>Hydration Activation of Dicalcium Silicate (C2S)</i></b> Jeffrey Thomas, Hamlin Jennings and Enrico Masoero
11:30am – 1:00 pm	<b>LUNCH</b> (on your own)

<b>Session 4   CHARACTERIZATION   1:00 – 2:00 pm</b>	
1:00 – 1:15 pm	<b><i>Reliable Specific Surface Measurements of Anhydrous Cement</i></b> Sara Mantellato, Marta Palacios Arevalo and Robert Flatt
1:15 – 1:30 pm	<b><i>Characterization and Development of a Paste and Mortar Isothermal Calorimeter for Calcium Aluminate Cement</i></b> Federico Aguayo, Anthony Bentivegna and Kevin Folliard
1:30 – 1:45 pm	<b><i>Microstructural Phase Identification of Calcium-Silicate Cement Pastes Using Nanoindentation Techniques</i></b> Warda Ashraf and Jan Olek
1:45 – 2:00 pm	<b><i>Simplifying the Thermal Conductivity (W/mK) and Coefficient of Thermal Expansion (CTE) Characterization of Insulative Concretes</i></b> Jarett Nickerson and Matthew Ouellette
2:00 – 2:30 pm	<b>BREAK</b> , STEM Center Lobby

The ACerS Cements Division presents the:

**2013 STEPHEN BRNAUER AWARD**

to

**JEFFREY J. THOMAS**

Schlumberger-Doll Research, Massachusetts, USA

In recognition of the best paper on cements published in 2012.

*The Instantaneous Apparent Activation Energy of Cement Hydration Measured Using a Novel Calorimetry-Based Method*

*Journal of the American Ceramic Society*, 95 [10] 3291-3296 (2012)

<b>Session 5   DURABILITY   2:30 – 3:45 pm</b>	
2:30 – 2:45 pm	<b><i>Development of Leachate Test for Delayed Ettringite Formation Potential in Cementitious Materials</i></b> Jojo France-Mensah and Benjamin Mohr
2:45 – 3:00 pm	<b><i>MicroCT Characterization of Degraded Cement Pastes: Density Profiles and Porosity Evolution</i></b> Lesa Brown and Florence Sanchez
3:00 – 3:15 pm	<b><i>New Model for Abrasion Resistance of Composite Materials</i></b> Emily Van Dam and David Lange
3:15 – 3:30 pm	<b><i>Prediction of Expansive Stress Due to Alkali Silica Reaction (ASR) in a Pure Phase System</i></b> Kai-Wei Liu, Anol Mukhopadhyay and Zach Grasley
3:30 – 3:45 pm	<b><i>The Impact of Curing on Curling Caused by Differential Drying Shrinkage in Paste and Concrete</i></b> Amir Hajibabae, Tyler Ley and Zach Grasley
3:45 – 4:15 pm	<b>BREAK</b> , STEM Center Lobby

<b>BUSINESS MEETING</b>	<b>4:15 – 5:00 pm</b>
<b>DELLA ROY LECTURE</b>	<b>5:00 – 6:00 pm</b> (See back for lecture information)
<b>DELLA ROY RECEPTION</b>	<b>6:30 – 9:30 pm</b> The Saltbox Inn 537 Hutcheson Road, Cookeville, TN 38506 Sponsored by Elsevier

## FRIDAY, JULY 11, 2014

<b>Ray Morris Hall</b> , STEM Center	
<b>Session 6   HYDRATION I   8:00 – 9:30 am</b>	
8:00 – 8:15 am	<b><i>Dimensional Stability of Layered Calcium Silicate Hydrates</i></b> Pouya Pourbeik, James Beaudoin, Laila Raki and Rouhollah Alizadeh
8:15 – 8:30 am	<b><i>Filling in the Gaps of Alite Hydration</i></b> Prannoy Suraneni and Robert J. Flatt
8:30 – 8:45 am	<b><i>Direct Three Dimensional Observations of the Dissolution and Subsequent Hydration of C<sub>3</sub>S</i></b> Qinang Hu, Tyler Ley, Mohammed Aboustait and Jay Hanan
8:45 – 9:00 am	<b><i>Influences of Solution Chemistry on the Driving Force, Kinetics, and Microstructure of Hydrating Tricalcium Silicate</i></b> Jeffrey Bullard, George Scherer and Jeffrey Thomas
9:00 – 9:15 am	<b><i>Toward a Computationally Efficient Model of Dissolution, Nucleation and Growth in Hydrating Cement Paste</i></b> George Scherer and Jeffrey Bullard
9:15 – 9:30 am	<b><i>Investigation of Recent C<sub>3</sub>S Hydration Inferences: A Multi-Constrained Multi-Ionic Continuum-Based Single Particle Modeling Strategy</i></b> Manohar Gottapu and Joseph Biernacki
9:30 – 10:00 am	<b>BREAK</b> , STEM Center Lobby

<b>Session 7   HYDRATION II   10:00 – 11:30 am</b>	
10:00 – 10:15 am	<b><i>Reaction Volume-Dependent Competition Between Calcium Silicate Hydration and Carbonation</i></b> Nicola Ferralis, Deepak Jagannathan, Jeffrey C. Grossman and Krystyn J. Van Vliet
10:15 – 10:30 am	<b><i>The Anomalous Behavior of Nanconfined Water in the Interlayer Spacing of Calcium-Silicate-Hydrates</i></b> Mohammed Javad Abdolhosseini Qomi, Mathieu Bauchy, Franz-Josef Ulm and Roland Pellenq
10:30 – 10:45 am	<b><i>Characterizing and Mitigating the Influences of Cement Prehydration: Insights from Experiments and Simulations</i></b> Julyan Stoian, Tandre Oey, Jeffrey Bullard, Jian Huang, Aditya Kumar, Magdalena Balonis, Judith Terrill, Narayanan Neithalath and Gaurav Sant
10:45 – 11:00 am	<b><i>Using Raman Spectroscopy to Characterize Hydration Process in Different Types of Cement Pastes</i></b> Fengjuan Liu and Zhihui Sun
11:00 – 11:15 am	<b><i>Accurate Atomistic Force Fields and Models for Cement Minerals and Aqueous Organic Interfaces</i></b> Tariq Jamil, Ratan Mishra, Robert J. Flatt and Hendrik Heinz
11:15 – 11:30 am	<b><i>Growth Model in Setting Behavior of Mortars</i></b> Chang Hoon Lee and Kenneth Hover
11:30am – 1:00 pm	<b>LUNCH</b> (on your own)

<b>Session 8   MECHANICS   1:00 – 2:45 pm</b>	
1:00 – 1:15 pm	<b><i>Improving the Fracture Toughness from Atomic Scale Modeling</i></b> Mathieu Bauchy, Mohammad Javad Abdolhosseini Qomi, Franz-Josef Ulm and Roland Pellenq
1:15 – 1:30 pm	<b><i>A Thermodynamic-Microstructure Model for Simulating the Onset of Damage in Cement Paste by External Sulfate Attack</i></b> Pan Feng, Jeffrey W. Bullard and Edward Garboczi
1:30 – 1:45 pm	<b><i>Elucidating the Intrinsic Permeability of Alkali-Activated Slag Cement Using the Beam-Bending Method</i></b> Catherine Eiben, George Scherer and Claire White
1:45 – 2:00 pm	<b><i>Hexagonal Boron Nitride and Graphite Oxide Reinforced Multifunctional Porous Cement Composites</i></b> Rouzbeh Shahsavari and Navid Sakhavand
2:00 – 2:15 pm	<b><i>Long-Term Concrete Prism Tests (ASTM C 1293) Evaluating ASR Using Novel Binary Cementitious Binders</i></b> Jared Wright and Farshad Rajabipour
2:15 – 2:30 pm	<b><i>Experimental and Thermodynamic Modeling Approach to Elucidate Damage Mechanisms in Cement-Well Casting-Host Rock Settings for Underground Storage of CO<sub>2</sub></i></b> Chang Li, Vahid Jafari Azad, David Rodriguez, Jason Ideker and Burkan Isgor
2:30 – 2:45 pm	<b><i>Finite Element Analysis of the DC Electrical Resistivity of Short-Fiber Reinforced Cement Paste</i></b> Joshua Hogancamp and Zach Grasley



## 2014 DELLA ROY LECTURE



### **40 Years a Cement Scientist – can this be Sustainable?**

Ellis Gartner, Scientific Director (Chemistry)  
Lafarge Central Research, France

Science is the study of nature, while engineering is one important aspect of the application of scientific theory to addressing the needs of society. The study of cement necessarily spans the two, since cement is a man-made material and we only make it in large volumes because we need it for concrete engineering works. Thus, cement scientists mainly justify their existence on the grounds that they can make a difference to concrete engineering, which is one of the mainstays of modern society. This lecture will cover several aspects of my career in cement-related industrial research, and will give some real examples of how a scientific approach can lead to technical innovations that in turn have the potential to improve the “sustainability” of concrete construction.

Dr. Ellis Gartner is the Scientific Director for Chemistry at Lafarge’s Central Research Laboratory near Lyon, France. He has a PhD in Physical Chemistry from the University of Cambridge (1975). After three years as a Higher Scientific Officer at the UK Department of the Environment’s Building Research Establishment, he moved to the Portland Cement Association (Illinois, USA) in 1977, where he later became the head of the Basic Research Section. In 1985 he joined the Central Research Laboratory of W. R. Grace & Co. in Columbia, Maryland, where he headed the Cement and Concrete Additives research group, under the direction of Jan Skalny. In 1996 he joined Lafarge Central Research as Director of the Cement-Admixture Interactions department, and in 2011 was promoted to his current position. He is a Fellow of The American Ceramic Society and a former chair of the Cements Division, as well as a recipient of the Brunauer Award in 1992. He is also a fellow of the Institute of Materials, Mining and Metallurgy (UK); a member of the American Chemical Society, of the Materials Research Society, and of RILEM; and an Associate Editor of the Cement and Concrete Research Journal. He has published over 60 scientific articles and over 30 patents.

In a 40-year career spent mainly in industrial research and development laboratories, he has worked on many aspects of construction materials, including: life-cycle analysis of construction materials; the energy efficiency of the cement manufacturing process; the manufacture of artificial aggregates for concrete; methods of analysing and controlling toxic gas emissions from cement kilns; methods of analysing and controlling cement raw materials; the development of novel functional and processing additions for cements; the development of novel admixtures for concrete, and, most recently, the development of novel hydraulic binders for concretes with lower carbon footprints.

The Della Roy Lecture is sponsored by Elsevier

## POSTER SESSION

### **– Linking Zeolite Properties and the Performance of Cementitious Mixtures Using Natural Zeolites as SCMs**

Lisa Burris and Maria Juenger

### **– Conflicting Functionality of a Potential Shrinkage Reducing Compound: Molecular Dynamics Study**

Ojas Chaudhari, Joseph Biernacki and Scott Northrup

### **– Setting and Nanostructural Evolution of Geopolymers**

Xu Chen and Leslie Struble

### **– Comparison of Methods for Discerning Cement Grain Boundaries in Micro CT Images**

Christopher Galitz, Zachary Grasley and Tyler Ley

### **– Effect of Induced Stresses on Cement Paste Composition**

Christopher Galitz, Zachary Grasley and Tyler Ley

### **– Attenuation of Vibrations in Fresh Concrete**

Ahmad Ghadban, Mohammed Albahtiti, Kyle Riding, and David Lange

### **– Viscoelastic Measurement by Indentation of C-(A)-S-H of Varied Chemical Composition**

William Hunnicutt, Paramita Mondal and Leslie Struble

### **– Mechanical and Electrical Properties of Cement Paste with Multi-walled Carbon Nanotubes**

Sung-Hwan Jang, Huiming Yin and Shiho Kawashima

### **– Freeze-Thaw and Scaling Resistance of Concrete Made from Calcium Silicate-based Cement**

Hyungu Jeong, Jan Olek, Jitendra Jain, Deepak Ravikumar and Vahit Atakan

### **– Broadband Dielectric Spectroscopy Technique: A Powerful and Versatile Experimental Tool for Studying Cementitious Materials**

Joshua Ojo, Nan Guo and Benjamin Mohr

### **– Characterization of Relaxation Times of Internally Cured Mortars**

Joshua Ojo, Benjamin Mohr and Nan Guo

### **– Relationship between Damage, Acoustic Nonlinearity Parameter, and Dielectric Properties: A Study of Alkali-Silica Reaction in Concrete**

Mohammad Rashidi, Marc Knapp, Álvaro Paul, Ashkan Hashemi, Kristen Donnell, Reza Zoughi, Jin-Yeon Kim, Laurence Jacobs and Kimberly Kurtis

### **– Effect of Nano-particle Addition on the Chemo-mechanical Behavior of Cement-based Materials Subjected to High Temperatures**

Yonathan Reches, David Kosson and Florence Sanchez

### **– Three-dimensional Analysis of the Air-void System in Hardened Concrete**

Yu Song, Ruofei Zou and David Lange

### **– Nanoscratch Test as a Tool to Characterize Cementitious Repair Material Bonding**

Peter Stynoski, Paramita Mondal and Charles Marsh

### **– Solidia Cement™ – A Novel Calcium Silicate-based Cement – Microstructure and Soak-Solution Chemistry**

Raikhana Tokpatayeva, Jan Olek, Jitendra Jain, Sadanand Sahu and Vahit Atakan

### **– Air Void Clustering**

Jan Vosahlik and Kyle Riding

### **– Metakaolin-limestone Blended Cement: Early Age Behavior**

Behnaz Zaribaf, Ahmad Shalan, Elizabeth Nadelman and Kimberly Kurtis



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## FINAL PROGRAM

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