



# 1st International Conference in North America on Nanotechnology in Cement and Concrete

May 5–7, 2010

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Irvine, California

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Portland Cement Association  
International Union of Laboratories and Experts in Construction Materials,  
Systems, and Structures (RILEM, from the name in French)

The objective of this conference is to advance the science and engineering of nanotechnology in modifying and monitoring the behavior and performance of cement and concrete at the nanoscale. Nanomodification of concrete is potentially capable of dramatically improving its tensile strength, toughness, ductility, and durability properties. This conference provides a unique opportunity for scientists, engineers, and practitioners to help determine the future direction of the use of nanotechnology in cement and concrete.



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May 5-7, 2010

## Registration and Reception

**WEDNESDAY, May 5**

5:30 p.m.–7:00 p.m., *Hyatt Regency Newport Beach Hotel*

## Conference Sessions

**THURSDAY, May 6**

7:00 a.m.–8:00 a.m.

**Registration and Breakfast**

8:00 a.m.–9:00 a.m.

**Opening Session**

**Welcome and Introductory Remarks**

Mohammad S. Khan, Professional Service Industries, Inc.  
Surendra P. Shah, Northwestern University

9:00 a.m.–9:30 a.m.

**Break**

9:30 a.m.–11:30 a.m.

**Improvement Through Nanosilica**

Peter C. Taylor, Iowa State University, *presiding*

**Small Changes Can Make a Great Difference** (NANO10-0019)

Juan José Gaitero, LABEIN, Spain; Igor Campillo, CIC nanoGUNE Consolider, Spain; Paramita Mondal, University of Illinois at Urbana–Champaign; Surendra P. Shah, Northwestern University

**Comparative Study of the Effects of Microsilica and Nanosilica in Concrete** (NANO10-0050)

Paramita Mondal, University of Illinois at Urbana–Champaign; Surendra P. Shah, Northwestern University; Juan José Gaitero, LABEIN, Spain

**Performance of Cement Systems with Nano-SiO<sub>2</sub> Particles Produced by Using the Sol-Gel Method** (NANO10-0054)

Konstantin Sobolev, University of Wisconsin, Milwaukee

**Influence of Nano-SiO<sub>2</sub> Addition on Microstructure and Mechanical Properties of Cement Mortars for Ferrocement** (NANO10-0059)

Payam Hosseini, Sharif University of Technology, Iran

**Nanostructure and Microstructure of Cement Concrete Incorporating Multicementitious Composites** (NANO10-0064)

Mohammad Iqbal Khan, King Saud University, Saudi Arabia

Wednesday and Thursday, May 5–6, 2010

### Homogenization Model Examining the Effect of Nanosilica on Concrete Strength and Stiffness (NANO10-0067)

Tai Fan, Jung Joong Kim, and Mahmoud Reda Taha, University of New Mexico

11:30 a.m.–1:00 p.m.

#### Lunch

1:00 p.m.–3:00 p.m.

#### Use of Nanotechnology Toward Sustainability

Georgene M. Geary, Georgia Department of Transportation, *presiding*

#### Nanoindentation of Alkali-Activated Fly Ash (NANO10-0011)

Jiri Nemecek, Czech Technical University, Czech Republic

#### Influence of Additions of Anatase TiO<sub>2</sub> Nanoparticles on Early-Age Properties of Cement-Based Materials (NANO10-0026)

Amal R. Jayapalan, Bo Yeon Lee, Sarah M. Fredrich, and Kimberly E. Kurtis, Georgia Institute of Technology

#### Nanotechnology—New Tools to Address Old Problems (NANO10-0028)

James D. Grove, Suneel Vanikar, and Gary L. Crawford, Federal Highway Administration

#### Photocatalytic Properties of Cement-Based Plasters and Paints Containing Mineral Pigments (NANO10-0049)

Daniele Enea, Università degli Studi di Palermo, Italy; Gian Luca Guerrini, CTG, Italcementi Group, Italy

#### Seeding Effect of Nano-CaCO<sub>3</sub> on the Hydration of Tricalcium Silicate (NANO10-0058)

Taijiro Sato, National Research Council of Canada; Fatoumata Diallo, University of Ottawa, Canada

#### Influence of Micro- and Nanoclays on Fresh State of Concrete (NANO10-0066)

Nathan Tregger, Margaret Pakula, and Surendra P. Shah, Northwestern University

3:00 p.m.–3:30 p.m.

#### Break

3:30 p.m.–5:30 p.m.

#### Nano Characterization

Bjorn Birgisson, KTH, Royal Institute of Technology, Sweden, *presiding*

#### Observation of Cement Paste Microstructure Evolution (NANO10-0015)

Giri Venkateela and Zhihui Sun, University of Louisville; Surendra P. Shah, Northwestern University

#### Micro- and Nanoscale Characterization of Effect of Interfacial Transition Zone on Tensile Creep of Ultra-High-Performance Concrete (NANO10-0016)

Victor Y. Garas, Amal R. Jayapalan, Lawrence F. Kahn, and Kimberly E. Kurtis, Georgia Institute of Technology

#### The Fresh State: From Macroscale to Microscale to Nanoscale ((NANO10-0044)

Raissa Douglas Ferron, University of Texas at Austin; Surendra P. Shah, Northwestern University

#### Atomic Force Microscopy Examinations of Mortar Made by Using Water-Filled Lightweight Aggregate (NANO10-0045)

Alva Peled, Ben Gurion University of the Negev, Israel; Javier Castro and William Jason Weiss, Purdue University

**Atomic Force Acoustic Microscopy to Measure Nanoscale Mechanical Properties of Cement Pastes** (NANO10-0053)

Jae Hong Kim, Oluwaseyi Balogun, and Surendra P. Shah, Northwestern University

5:30 p.m.–7:00 p.m.

**Meet-the-Author Poster Session**

**Ultrasonic Technology for Characterizing Multiscale Pore Structure of Concrete** (NANO10-0060)

Yan Liu and Xiong Yu, Case Western Reserve University

**Transmission Electron Microscopy on Cementitious Binders Modified by Carbon Nanotubes** (NANO10-0056)

Torsten Kowald, University of Siegen, Germany; Reinhard Trettin, Institute for Building and Material Chemistry, Germany

**Effects of Nanosilica Fume on the Microstructure and Performance Properties of Hydration Materials** (NANO10-0048)

Bin Zhang, Yan Liu, Zhen Liu, Xuejun Zhu, and Xiong Yu, Case Western Reserve University

**Multiphysical Simulation of Cement Hydration** (NANO10-0047)

Bin Zhang and Xiong Yu, Case Western Reserve University

**Long-Term Behavior of Silica Fume in Concrete** (NANO10-0042)

Neal S. Berke, W.R. Grace & Company

**Modeling Load-Displacement Curve Obtained in Depth-Sensing Indentation for Cementitious Materials** (NANO10-0041)

Kaushal Jha and Nakin Suksawang, Florida International University

**High-Temperature Nanoindentation and Its Application to Cementitious Materials** (NANO10-0036)

Krishna Rajan, Iowa State University

**Informatics for Design of Nanoscale Design of Cement Chemistry** (NANO10-0035)

Krishna Rajan, Iowa State University

**Characterization of Halloysite Nanotubes** (NANO10-0034)

Krishna Rajan, Iowa State University

**Effect of Exfoliated Nanoclay on the Interfacial Transition Zone in Concrete** (NANO10-0024)

Mahir Dham, NanoDynamics Inc.; Bjorn Birgisson, KTH, Royal Institute of Technology, Sweden

**Piezoresistive MWNTs-Filled, Cement-Based Composites for Smart Civil Structures** (NANO10-0012)

Baoguo Han and Xun Yu, University of Minnesota, Duluth; Jinping Ou, Harbin Institute of Technology, China

**Flow-Induced Fiber Orientation in Self-Consolidating SFRC: Nondestructive Monitoring and Prediction Through Casting Flow Simulation** (NANO10-0061)

Liberato Ferrara, Politecnico di Milano, Italy; Nathan Tregger and Surendra P. Shah, Northwestern University

Thursday, May 6, 2010

## FRIDAY, May 7

7:00 a.m.–8:00 a.m.

### Breakfast

8:00 a.m.–10:00 a.m.

### Nanomodification

Paul F. Mlakar, U.S. Army Corps of Engineers, *presiding*

#### **Exploratory Investigation of Nanomaterials to Improve Strength and Permeability of Concrete** (NANO10-0029)

Celik Ozyildirim, Virginia Transportation Research Council

#### **Laboratory Assessment of A Self-Healing Cementitious Composite** (NANO10-0030)

Zhengxian Yang and Xiaodong He, Western Transportation Institute; John Hollar and Xianming Shi, Montana State University

#### **The Enhancement of Reactive Powder Concrete via Nanocement Integration** (NANO10-0039)

Mahir Dham, NanoDynamics Inc.; Todd S. Rushing, U.S. Army Engineer Research and Development Center (ERDC)

#### **Nanocellulose and Microcellulose Fibers for Concrete** (NANO10-0040)

Sarah Peters and Eric Landis, University of Maine; Todd S. Rushing and Toney Cummins, U.S. Army Engineer Research and Development Center (ERDC)

#### **Nanotechnology to Manipulate the Aggregate–Cement Paste Bond: Effects on Mortar Performance** (NANO10-0043)

Jessica Sanfilippo, University of Wisconsin-Madison

#### **New Possibilities and Future Pathways of Nanoporous Thin Film Technology to Improve Concrete Performance** (NANO10-0046)

Jose Francisco Munoz, University of Wisconsin, Madison

10:00 a.m.–10:30 a.m.

### Break

10:30 a.m.–12:30 p.m.

### Modeling and Calcium-Silicate-Hydrates (C-S-H)

Edward J. Garboczi, National Institute of Standards and Technology, *presiding*

#### **New Calcium Silicate Hydrate Network** (NANO10-0014)

Luc Nicoleau, BASF CC, GKI/M, Germany

#### **Stability of Synthetic C-S-H Gels in Presence of Alkalis, Aluminum, and Soluble Silica** (NANO10-0017)

Ines Garcia-Lodeiro and Eduardo Torroja, Instituto de Ciencias de la Construcción, Spain

#### **Molecular Dynamics Study of Interaction Between Corrosion Inhibitors, Nanoparticles, and Other Minerals in Hydrated Cement** (NANO10-0033)

Yajun Liu and Xianming Shi, Montana State University

**Modeling Nanoindentation of Calcium Silicate Hydrate** (NANO10-0037)

Mei Qiang Chandler and John Peters, U.S. Army Corps of Engineers ERDC; Daniele Pelessone, Engineering and Software System Solutions, Inc.

**Molecular Dynamics to Understand the Mechanical Behavior of Cement Paste** (NANO10-0038)

R. Panneer Selvam, University of Arkansas, Fayetteville

**Scanning Transmission X-Ray Microscopic Study of Carbonated C-S-H** (NANO10-0062)

Juyoung Ha, University of California, Berkeley

12:30 p.m.–2:00 p.m.

**Lunch**

2:00 p.m.–4:00 p.m.

**Carbon Nanofibers**

Antonio Porro, LBEIN, *presiding*

**Distribution of Carbon Nanofibers and Nanotubes in Cementitious Composites** (NANO10-0027)

Ardavan Yazdanbakhsh, Zachary C. Grasley, Bryan Tyson, and Rashid K. Abu Al-Rub, Texas A&M University

**Direct Synthesis of Carbon Nanofibers on Cement Particles** (NANO10-0031)

Larisa Nasibulina, Helsinki University of Technology, Finland

**Strength Enhancement of Cement Mortar with Carbon Nanotubes: Early Results and Potential** (NANO10-0052)

Tanvir Manzur and Nur Yazdani, University of Texas, Arlington

**Performance of Carbon Nanofiber–Cement Composites with a High-Range Water-Reducer** (NANO10-0055)

Catherine S. Gay and Florence Sanchez, Vanderbilt University

**Carbon Nanofiber–Reinforced Cement-Based Materials** (NANO10-0057)

Zoi Metaxa and Surendra P. Shah, Northwestern University; Maria Konsta-Gdoutos, Democritus University of Thrace; Greece

**Nanoengineering Ultra-High-Performance Concrete with Multiwalled Carbon Nanotubes** (NANO10-0063)

Kay Wille, University of Michigan; Kenneth J. Loh, University of California, Davis

4:00 p.m.–4:30 p.m.

**Break**

4:30 p.m.–5:30 p.m.

**Future of Nanotechnology**

Suneel N. Vanikar, Federal Highway Administration, *presiding*

**Nanotechnology and Concrete—Concepts and Approach** (NANO10-0032)

Antonio Porro, Jorge S. Dolado, Juan José Gaitero and Hegoi Manzano, LBEIN, Spain

**American Road Map for Research for Nanotechnology-Based Concrete Materials** (NANO10-0023)

Bjorn Birgisson, KTH, Royal Institute of Technology, Sweden; Peter C. Taylor, Iowa State University; Jamshid M. Armaghani, Florida Concrete & Products Association; Surendra P. Shah, Northwestern University

5:30 p.m.–6:00 p.m.

**Reception**

6:00 p.m.–7:30 p.m.

**Banquet**

Friday, May 7, 2010

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