

14TH ANNUAL

ADVANCES IN CEMENT-BASED MATERIALS

JUNE 19-21, 2024

MISSOURI S&T | ROLLA, MO

ORGANIZED BY THE
CEMENTS DIVISION OF

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WELCOME TO THE 14TH ADVANCES IN CEMENT-BASED MATERIALS CONFERENCE!

We are delighted to welcome you to the 14th Advances in Cement-Based Materials Conference, hosted by The American Ceramic Society. This year's event is held at the Department of Civil, Architectural, and Environmental Engineering at the Missouri University of Science and Technology in Rolla, MO. This conference is an unparalleled opportunity for experts, researchers, and professionals to gather and discuss the latest innovations and research in cement-based materials.

Our technical program is rich with diverse lectures, sessions, and networking opportunities designed to inspire and advance our collective knowledge. We are honored to have Dr. Shiho Kawashima from Columbia University as our keynote speaker on Wednesday morning. Dr. Kawashima will present on "Cement Rheology And Processing – why give a CRAP," providing insights into the complexities and advancements in cement processing.

We are also privileged to feature Dr. Maria Juenger from the University of Texas at Austin as our Della Roy Lecturer. Dr. Juenger will present "Cement and Concrete in a Sustainable World," sharing her extensive research on the sustainability and durability of cement-based materials, highlighting the critical intersection of material science and environmental stewardship.

Additionally, we will honor Dr. Edward Garboczi in a special session recognizing his significant contributions to the field as he retires. This session will reflect on his impactful career and legacy in cement-based materials research.

Our program also includes an industry panel discussion on Friday morning featuring esteemed panelists Jeff Thomas, Margarita Ley, and Matt D'Ambrosia. This session will provide valuable industry perspectives and discuss current challenges and future directions in cement technology.

Throughout the conference, 68 oral presentations in 12 parallel sessions will cover a broad array of topics, including:

- Cement hydration
- Sustainability and supplementary cementitious materials
- CO2 and carbon-neutral concrete
- Durability and service life
- Nanomaterials
- Advanced characterization techniques
- Computational and data science
- Bio-inspired materials
- Rheology and additive manufacturing

During the Della Roy reception, we have the poster session with approximately 25 presentations in the advanced construction materials laboratory (ACML). We strongly encourage you to interact with the poster presenters while enjoying the reception. Winners of the poster competition will be announced during the closing ceremony on Friday.

One of the strengths of the ACerS cements division annual meeting is the interaction with young members. We would therefore like to extend a special welcome to our young members, and we hope you find a scientific home in the ACerS community. We encourage all attendees to engage actively in the discussions, share their expertise, and form valuable, long-lasting connections.

Thank you for joining us. We look forward to an enriching and inspiring conference at Missouri S&T.

Dimitri Feys, Missouri S&T

Wil V. Srubar, III, University of Colorado-Boulder

Vicki Evans, ACerS

CONFERENCE ORGANIZERS



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ADVANCES IN CEMENT-BASED MATERIALS OFFICERS

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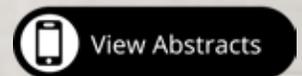
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Student Advisors Delegate
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Juan Pablo Gevaudan
YPN Division Liaison The
Pennsylvania State University

Kendra Erk
DEI Representative
Purdue University



AGENDA AND SCHEDULE OF EVENTS

TUESDAY, JUNE 18	LOCATION	TIME
Cement Plant Tour	Holcim Ste-Genevieve	2:00pm
YPN+1 Event	Lion's Club Park	6:30pm

WEDNESDAY, JUNE 19	LOCATION	TIME
Registration & Coffee	Atrium	7:45am - 8:15am
Opening Remarks	Room 125	8:15am - 8:30am
Keynote Speaker: Shiho Kawashima	Room 125	8:30am - 9:15am
Business Meeting	Room 125	9:15am - 10:00am
Coffee Break	Atrium	10:00am - 10:25am
BREAKOUT SESSION 1A and 1B (2hr)		10:25am - 12:25pm
1A: Sustainability and SCMs (Part 1 of 3)	Room 125	
1B: Material Characterization	Room 120	
Lunch		12:25pm - 1:40pm
BREAKOUT SESSION 2A and 2B (2hr)		1:40pm - 3:40pm
2A: Sustainability and SCMs (Part 2 of 3)	Room 125	
2B: Bio-Inspired Cementitious Materials	Room 120	
Coffee Break	Atrium	3:40pm - 4:05pm
Della Roy Lecture	Room 125	4:05pm - 5:15pm
Poster Session	ACML	5:15pm - 7:30pm
Della Roy Reception		

THURSDAY, JUNE 20	LOCATION	TIME
Registration & Coffee	Atrium	7:45am - 8:15am
Session in Honor of Edward Garboczi	Room 125	8:15am - 9:45am
Coffee Break	Atrium	9:45am - 10:10am
BREAKOUT SESSION 3A and 3B (2 hr)		10:10am - 12:10pm
3A: Cement Chemistry (Part 1 of 2)	Room 125	
3B: Microstructure Stabilization	Room 120	
Lunch		12:10pm - 1:25pm
BREAKOUT SESSION 4A and 4B (1 hr20m)		1:25pm - 2:45pm
4A: Computational and Data Science	Room 125	
4B: Durability and Service Life Modeling	Room 120	
Coffee Break	Atrium	2:45pm - 3:10pm
Breakout Session 5A and 5B (2 hr)		3:10pm - 5:10pm
5A: Cement Chemistry (Part 2 of 2)	Room 125	
5B: CO2 Utilization Towards Carbon-Neutral Concrete	Room 120	
DEI Event: Experimental Mine	Missouri S&T Experimental Mine	5:30pm - 6:15pm

FRIDAY, JUNE 21	LOCATION	TIME
Registration & Coffee	Atrium	7:45am - 8:15am
Panel Discussion on Industry Involvement	Room 125	8:15am - 9:15am
Coffee Break	Atrium	9:15am - 9:40am
BREAKOUT SESSION 6A AND 6B (2 HR)		9:40am - 11:40am
6A: Sustainability and SCMs (Part 3 of 3)	Room 125	
6B: Rheology and Additive Manufacturing	Room 120	
Closing Remarks	Room 125	11:40am - 12:00pm

MEETING REGULATIONS



NO PHOTOGRAPHY/ RECORDING CELL PHONES SILENT

During sessions conducted during Society meetings, unauthorized photography, videotaping, and audio recording is strictly prohibited for two reasons: (1) conference presentations are the intellectual property of the presenting authors as such are protected, and (2) engaging in photography, videotaping, or audio recording is disruptive to the presenter and the audience. Failure to comply may result in the removal of the offender from the session or from the remainder of the meeting.

Note: The Society may engage photographers to photograph sessions for marketing and promotional purposes.

Rooms 120 & 125, ACML, and the Atrium are located at Missouri S&T, Butler-Carlton Hall: 1401 N. Pine Street, Rolla, MO, 65409

ADVANCES IN CEMENT-BASED MATERIALS

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WEDNESDAY, JUNE 19

PROGRAM	LOCATION	TIME
Registration & Coffee	Atrium	7:45am - 8:15am
Opening Remarks	Room 125	8:15am - 8:30am
KEYNOTE SPEAKER: Cement Rheology & Processing - Why Give a CRAP? Shiho Kawashima <i>Columbia University</i>	Room 125	8:30am - 9:15am
Business Meeting	Room 125	9:15am - 10:00am
Coffee Break	Atrium	10:00am - 10:25am
BREAKOUT SESSION 1A (2hr) SUSTAINABILITY & SCMS (PART 1 OF 3) MODERATOR: NISHANT GARG, UIUC	Room 125	10:25am - 12:25pm
THE MECHANICAL AND TRANSPORT PROPERTIES OF WASTE LIMESTONE FILLER CONCRETE Ruben Paul Borg <i>Faculty for the Built Environment, University of Malta, Msida, Malta</i> Cyril Lynsdale <i>Department of Civil & Structural Engineering, University of Sheffield Sheffield, United Kingdom</i>		10:25am
REACTIVITY OF AMORPHOUS ALUMINOSILICATES UPCYCLED FROM WASTE CEMENT PASTE Ah-Hyung, Shiho Kawashima, Alissa Park, Joanh M. Williams, Diandian Zhao <i>Columbia University, New York, NY</i>		10:45am
VATERITE PERFORMANCE AS AN SCM EXTENDER AND BINDER Craig W. Hargis, Jesus Gonzalez Pequeno, Ying Wang <i>Product Development, Fortera, San Jose, CA</i>		11:05am
OVERVIEW OF CAST STONE AS A CEMENTITIOUS WASTE FORM FOR SIMULATED AND REAL LOW ACTIVITY WASTE Matthew R. Asmussen, Jonathan L. Lapeyre, Sarah A. Saslow, Gary L. Smith <i>Energy & Environment Division, Pacific North West National Laboratory, Richland, WA</i>		11:25am
VALORIZATION OF WASTE-TO-ENERGY ASHES IN CEMENTITIOUS SYSTEMS VIA MINERALOGICAL TRANSFORMATIONS Aniruddha Baral, Nishant Garg, Vikram Kumar, Jeffery Roesler <i>Civil & Environmental Engineering, University of Illinois at Urbana-Champaign, Urbana, IL</i>		11:45am
TERNARY BLENDED CEMENT WITH OFF-SPECIFICATION SCMS Alexander S. Brand <i>Civil & Environmental Engineering, Virginia Tech, Blacksburg, VA</i>		12:05pm

WEDNESDAY, JUNE 19 (CONTINUED)

BREAKOUT SESSION 1B (2hr) MATERIAL CHARACTERIZATION <i>MODERATOR: MARIA JUENGER, UNIVERSITY OF TEXAS AUSTIN</i>	Room 120	10:25am - 12:25pm
<p>PHASE IDENTIFICATION & QUANTIFICATION OF ANHYDROUS CEMENTS VIA COMBINED X-RAY DIFFRACTION AND RAMAN IMAGING Nishant Garg <i>Civil & Environmental Engineering, University of Illinois Urbana Champaign, Urbana, IL</i> Chirayu Kothari <i>University of Illinois Urbana Champaign, Urbana, IL</i></p>		10:25am
<p>NOVEL USE OF HYPHENATED TG-IR TO QUANTIFY DEGREE OF HYDRATION IN COMPLEX CEMENTITIOUS SYSTEMS Julia Hylton <i>Materials Science, Colorado School of Mines, Golden, CO</i> Lori Tunstall <i>Civil & Environmental Engineering, Colorado School of Mines, Golden, CO</i></p>		10:45am
<p>SYNCHROTRON MICROTOMOGRAPHY APPLIED TO THE STUDY OF NEUTRON-INDUCED CRACKS ON IRRADIATED AGGREGATE Paula C. Bran Anleu <i>Nuclear Energy & Fuel Cycle Division, Oak Ridge National Laboratory, Oak Ridge, TN</i> Adam Brooks, David Arregui Mena <i>Oak Ridge National Laboratory, Oak Ridge, TN</i> Mark Rivers <i>Advanced Photon Source, Argonne National Laboratory, Lemont, IL</i> Elena Tajuelo Rodriguez <i>Reactor & Nuclear Systems Division, Oak Ridge National Laboratory, Oak Ridge, TN</i></p>		11:05am
<p>HIGH NEUTRON AND GAMMA DOSE EFFECTS ON C-S-D Paula C. Bran Anleu, Joerg C. Neufeind <i>Nuclear Energy & Fuel Cycle Division, Oak Ridge National Laboratory, Oak Ridge, TN</i> Nishant Garg <i>Civil & Environmental Engineering, University of Illinois Urbana Champaign, Urbana, IL</i> Yann Le Pape, Elena Tajuelo Rodriguez <i>Reactor & Nuclear Systems Division, Oak Ridge National Laboratory Oak Ridge, TN</i></p>		11:25am
<p>NEW INSIGHTS ON SURFACE PROPERTIES OF CEMENTITIOUS MATERIALS GATHERED BY INVERSE GAS CHROMATOGRAPHY (IGC) AT INFINITE AND FINITE DILUTION CONDITIONS Franco Zunino <i>Institute for Building Materials, ETH Zurich, Zurich, Switzerland</i></p>		11:45am
<p>THE INTRINSIC MECHANICAL PROPERTIES AND CREEP OF CALCIUM SILICATE HYDRATE Jiaqi Li <i>Lawrence Livermore National Laboratory, Livermore, CA</i></p>		12:05pm

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WEDNESDAY, JUNE 19 (CONTINUED)

PROGRAM	LOCATION	TIME
Lunch		12:25pm - 1:40pm
BREAKOUT SESSION 2A (2hr) SUSTAINABILITY & SCMS (PART 2 OF 3) <i>MODERATOR: DENISE SILVA, OAK RIDGE NL</i>	Room 125	1:40pm - 3:20pm
AN ECO-FRIENDLY CARBONATION METHOD FOR HYDRATED CEMENT PASTE Abdulmalik Alawode, Monica Amaral, Maysam Bahmani, Xi Chen, Xiaodong Wang, <i>The University of Alabama, Tuscaloosa, AL</i> Jialai Wang <i>Civil, Construction, and Environmental Engineering,</i> <i>The University of Alabama, Tuscaloosa, AL</i>		1:40pm
HIGH FILLER, LOW WATER (HFLW) CEMENT-BASED MIXTURES FOR CARBON EMISSIONS REDUCTION R.G. Pileggi, M.S. Rebmann <i>University of São Paulo, São Paulo, Brazil</i> D.A. Silva <i>Oak Ridge National Laboratory, Oak Ridge, United States</i>		2:00pm
HYDRATION AND CARBONATION BEHAVIOR OF A PURE C-S-H - CALCITE BINDER Melissa Mills, Chven Mitchell, Jessica M. Rimsza, Atolo A. Tuinukuafe, Hongkyu Yoon, <i>Sandia National Laboratories, Albuquerque, NM</i>		2:20pm
AN ULTRA-RAPID REACTIVITY (UR2) TEST FOR REAL-TIME QUALITY CONTROL OF CALCINED CLAYS Nishant Garg, Hossein Kabir <i>Civil & Environmental Engineering, University of Illinois Urbana Champaign, Urbana, IL</i> Muhammad Farjad Iqbal, Chirayu Kothari, Yujia MIN <i>University of Illinois Urbana Champaign, Urbana, IL,</i>		2:40pm
ON THE USE OF ISOTHERMAL CALORIMETRY TO UNVEIL FLY ASH REACTIVITY IN AQUEOUS ENVIRONMENTS Rohan R. Bhat, Taihao Han, Aditya Kumar <i>Materials Science & Engineering, Missouri University of Science & Technology, Rolla, MO</i> Narayanan Neithalath <i>Civil Engineering, Arizona State University, Tempe, AZ</i> Gaurav Sant <i>University of California Los Angeles, CA</i>		3:00pm
EFFECTS OF CALCIUM HYDROXIDE AND MAGNESIUM OXIDE IN ALKALI-ACTIVATED METAKAOLIN WITH LOW ACTIVATOR CONCENTRATIONS Claire E. White <i>Department of Civil & Environmental Engineering, and the Andlinger Center for Energy & the Environment, Princeton University, Princeton, NJ</i> Anita Zhang <i>Civil and Environmental Engineering, Princeton University, Princeton, NJ</i>		3:20pm

WEDNESDAY, JUNE 19 (CONTINUED)

BREAKOUT SESSION 2B (2hr) BIO-INSPIRED CEMENTITIOUS MATERIALS <i>MODERATOR: CAITLIN ADAMS, UNIVERSITY OF COLORADO BOULDER</i>	Room 120	1:40pm - 3:40pm
BIOMIMETIC EARTH-BASED CEMENT PASTE OPTIMISED THROUGH RAPID BINDING ASSESSMENT TECHNIQUES Samuel J. Armistead, Wil V. Srubar III <i>Civil, Environmental, & Architectural Engineering, University of Colorado, Boulder</i> Rebecca A. Mikofsky <i>Materials Science & Engineering Program, University of Colorado, Boulder</i>		1:40pm
AN ENZYMATIC CEMENTITIOUS MATERIAL Shuai Wang <i>Enzymatic, Inc, Las Vegas, NV</i>		2:00pm
METAKAOLIN-BASED GEOPOLYMER MIXES MODIFIED WITH ALGAL BIOMASS Cansu Acarturk, Brooklyn Lash, Wil V. Srubar III <i>Civil, Environmental & Architectural Engineering, University of Colorado Boulder, Boulder, CO</i>		2:20pm
SMALL DOZE ORGANIC ADDITIVES AUGMENTING BENEFIT OF BIOCHAR IN CONCRETE Abdulmalik Alawode, Monica Amaral, Maysam Bahmani, Xi Chen, Xiaodong Wang <i>The University of Alabama, Tuscaloosa, AL</i> Abdulmalik Bamidele Ismail, Jialai Wang <i>Civil, Construction, & Environmental Engineering, The University of Alabama, Tuscaloosa, AL</i>		2:40pm
INVESTIGATING FILLER AND SHEARING EFFECTS ON HYDRATION RATES OF CEMENT-BIOCHAR BLENDED PASTES Tung Hoang, Lori Tunstall <i>Civil & Environmental Engineering, Colorado School of Mines, Golden, CO</i> Julia Hylton <i>Materials Science, Colorado School of Mines, Golden, CO</i>		3:00pm
PHOTOSYNTHESIZED CaCO₃ AS A RAW MATERIAL FOR CEMENT CLINKER PRODUCTION Cansu Acarturk, Matthew H. Fyfe, Wil V. Srubar III <i>Civil, Environmental & Architectural Engineering, University of Colorado Boulder, Boulder, CO</i> Danielle N. Beatty <i>Materials Science & Engineering Program, University of Colorado Boulder, Boulder, CO</i>		3:20pm
Coffee Break	Atrium	3:40pm - 4:05pm
DELLA ROY LECTURE: The Road to Sustainable Cement Maria Juenger <i>University of Texas, Austin</i>	Room 125	4:05pm - 5:15pm
Poster Session	ACML	5:15pm - 7:30pm
Della Roy Reception	ACML	5:15pm - 7:30pm

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THURSDAY, JUNE 20

PROGRAM	LOCATION	TIME
Registration & Coffee	Atrium	7:45am - 8:15am
SESSION IN HONOR OF EDWARD GARBOCZI The Garboczi Legacy: A Computational Physicist's Guide to Cement and Concrete <i>Presenter: Jeff Bullard</i> Sustainability – More Than Macro: Could 3D Printing of Cement-Based Materials Be A Sustainable Solution to the Housing Crisis? <i>Presenter: Joe Biernacki</i> The Experiment Graveyard <i>Presenter: David Lange</i>	Room 125	8:15am - 9:45am
Coffee Break	Atrium	9:45am - 10:10am
BREAKOUT SESSION 3A (2hr) CEMENT CHEMISTRY (PART 1 OF 2) MODERATOR: JOE BIERNACKI, TENNESSEE TECH	Room 125	10:10am - 12:10pm
RAMAN IMAGING OF STATIC & DYNAMIC SYSTEMS Nishant Garg <i>Civil and Environmental Engineering, University of Illinois Urbana Champaign, Urbana, IL</i>		10:10am
EFFECT OF PHOSPHORUS AND FLUORINE FROM PHOSPHOGYPSUM ON C3S AND C3A HYDRATION Carlos P. Bergmann, Rayara Pinto Costa <i>Materials Engineering, Federal University of Rio Grande do Sul, Porto Alegre, Brazil</i> Maria Juenger <i>University of Texas at Austin, Austin, TX</i> Ana Paula Kirchheim <i>Civil Engineering, Federal University of Rio Grande do Sul, Porto Alegre, Brazil</i> Paulo R. de Matos, Jose S. Andrade Neto <i>Civil Engineering, State University of Santa Catarina, Laguna, Brazil</i>		10:30am
CALCIUM HYDROXIDE DISSOLUTION KINETICS: RATE EQUATION AND TEMPERATURE DEPENDENCE Yoonjung Han, Natasha Van Dam Levy <i>Zachry Department of Civil & Environmental Engineering, Texas A&M University, College Station, TX</i> Mine G. Ucak-Astarlioglu, Jedadiah F. Burroughs <i>Geotechnical and Structures Laboratory, U.S. Army Engineer Research & Development Center, Vicksburg, MS</i> Jeffrey W. Bullard <i>Department of Materials Science & Engineering, Texas A&M University, College Station, TX</i>		10:50am
EFFECT OF GYPSUM ON TRICALCIUM SILICATE IN BLENDED SYSTEMS: IN SITU ATOMIC PAIR DISTRIBUTION FUNCTION STUDY Nishant Garg, Hyeonseok Jee <i>Civil & Environmental Engineering, University of Illinois Urbana-Champaign, Urbana, IL</i> Chirayu Kothari <i>University of Illinois Urbana Champaign, Urbana, IL</i>		11:10am
EFFECT OF MINOR ELEMENTS AND AL/FE RATIOS ON FERRITE FORMATION AND HYDRATION Aniruddha Baral, Theodore Hanein <i>The University of Sheffield, Sheffield, United Kingdom</i> Cecilia Pesce <i>The University of Sheffield, United Kingdom</i>		11:30am
INVESTIGATING THE EFFECTS OF WATER ACTIVITY ON THE HYDRATION KINETICS & THERMODYNAMICS OF YE'ELIMITE CALCIUM SULFATE SYSTEM Godwin I. Ogbuehi, Monday U. Okoronkwo <i>Chemical & Biochemical Engineering, Missouri University of Science & Technology, Rolla, MO</i>		11:50am

THURSDAY, JUNE 20 (CONTINUED)

BREAKOUT SESSION 3B (2hr) MICROSTRUCTURE STABILIZATION <i>MODERATOR: DAVID LANGE</i>	Room 120	10:10am - 12:10pm
<p>A NATURE-INSPIRED APPROACH FOR SELF-REPAIR IN AGING CONCRETE STRUCTURES Yaghoob Farnam, Mohammad Irfan Iqbal, Geetika Mishra, Parsa Namakiaraghi, Irene Verdú, Ethan Yen <i>Civil, Architectural & Environmental Engineering, Drexel University, Philadelphia, PA</i></p> <p>Mija Hubler <i>Civil Environmental & Architectural Engineering, University of Colorado Boulder, Boulder, CO</i></p> <p>Hsiao Wei Lee, Ahmad Najafi, Christopher M. Sales <i>Drexel University, Philadelphia, PA</i></p>		10:10am
<p>HEALING CONCRETE USING BIOTECHNOLOGY Saurabh Dhiman, Clare Fischer, Christopher Shearer, Swati Srivastava <i>Civil & Environmental Engineering, South Dakota School of Mines & Technology, Rapid City, SD</i></p> <p>Rachel Krebs, Heather Luckarift, Fadime Murdoch <i>Battelle</i></p>		10:30am
<p>CAN SELF-HEALING CONCRETE SELF-DESTRUCT? EFFECTS OF UREA-RICH BIOMINERALIZING MICROORGANISM MEDIA ON THE CHEMICAL STABILITY OF PORTLAND CEMENT PASTE Cansu Acarturk, Caitlin Adams <i>Civil, Environmental & Architectural Engineering, University of Colorado Boulder, Boulder, CO</i></p> <p>Wil V. Srubar III <i>Materials Science and Engineering, University of Colorado Boulder, Boulder, CO</i></p>		10:50am
<p>EFFECTS OF NANO-ETTRINGITE ON THE HYDRATION OF PORTLAND CEMENT Rupack R. Halder, Monday U. Okoronkwo <i>Chemical & Biochemical Engineering, Missouri University of Science & Technology, Rolla, MO</i></p>		11:10am
<p>ENHANCEMENT OF HYDRATION AND STABILIZATION OF CEMENT CLINKERS USING CHEMICALLY MODIFIED TIB2 NANOSHEETS Vikash Kumar Singh <i>Indian Institute of Technology Gandhinagar, Gandhinagar, India</i></p>		11:30am
<p>C-S-H SEEDS: NEW INSIGHTS ON PORE STRUCTURE REFINEMENT Nishant Garg, Sudharsan Rathna Kumar, Faisal Qadri <i>Civil & Environmental Engineering, University of Illinois at Urbana-Champaign, Urbana, IL</i></p>		11:50am

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THURSDAY, JUNE 20 (CONTINUED)

PROGRAM	LOCATION	TIME
Lunch		12:10pm - 1:25pm
BREAKOUT SESSION 4A (1:20hr) COMPUTATIONAL & DATA SCIENCE <i>MODERATOR: JEFF THOMAS, GCP APPLIED TECHNOLOGIES</i>	Room 125	1:25pm - 2:45pm
HIERARCHICAL MACHINE LEARNING FOR THE MOLECULAR DESIGN OF NONIONIC POLYMERS AS AIR-ENTRAINING ADMIXTURES Ali Ghahremaninezhad, PhD <i>Civil, Architecture & Environmental Engineering, University of Miami, Coral Gables, FL</i> Sadegh Tale Masoule <i>University of Miami, Coral Gables, FL</i>		1:25pm
ON THE PREDICTION OF THE MECHANICAL PROPERTIES OF LIMESTONE CALCINED CLAY CEMENT: A RANDOM FOREST APPROACH TAILORED TO CEMENT CHEMISTRY Bryan K. Aylas Paredes, SR <i>Materials Science, Missouri University of Science & Technology, Rolla, MO</i>		1:45pm
UNDERSTANDING THE MULTISCALE DISSOLUTION OF CALCIUM ALUMINOSILICATE GLASSES Luis A. Ruiz Pestana <i>Civil, Architectural, & Environmental Engineering, University of Miami, Coral Gables, FL</i>		2:05pm
SORPTIVITY PREDICTION IN SECONDS: A COMPUTER VISION APPROACH Nishant Garg, Hossein Kabir <i>Civil & Environmental Engineering, University of Illinois Urbana Champaign, Urbana, IL</i>		2:25pm
BREAKOUT SESSION 4B (1:20hr) DURABILITY & SERVICE LIFE MODELING <i>MODERATOR: ELENA TAJUELO RODRIGUEZ, OAK RIDGE NL</i>	Room 120	1:25pm - 2:45pm
EXPLORING THE POTENTIAL CHANGES IN THE MORPHOLOGY AND THE NANOSTRUCTURES OF CEMENT HYDRATES DUE TO THE APPLICATION OF ELECTRIC FIELD EXCLUDING THE JOULE-HEATING EFFECT Abdelrahman Hamdan <i>Andlinger Center for Energy & the Environment, Princeton University, Princeton, NJ</i> Claire E. White <i>Department of Civil & Environmental Engineering, and the Andlinger Center for Energy & the Environment, Princeton University, Princeton, NJ</i>		1:25pm
TRACKING AND QUANTIFYING THE CARBONATION-FRONT VIA MULTI-MODAL IMAGING Nishant Garg, Sudharsan Rathna Kumar <i>Civil & Environmental Engineering, University of Illinois Urbana Champaign, Urbana, IL</i>		1:45pm
ASSESSING THE PERFORMANCE OF INTERNAL CURED CONCRETE USING PRE-SATURATED LIGHTWEIGHT CERAMICS MANUFACTURED FROM LANDFILL CONDITION WASTE COAL ASH Yousif Alqenai <i>Drexel University, Philadelphia, PA</i> Yaghoob Farnam, Bankole Tejuoso, Sharaniya Visvalingam <i>Civil, Architectural, & Environmental Engineering, Drexel University, Philadelphia, PA</i>		2:05pm
EFFECT OF ALKALI CATIONS IN DIFFERENT ENVIRONMENTS ON ALKALI SILICA REACTION (ASR) Pengfei Ma <i>Department of Civil, Architectural, & Environmental Engineering Missouri University of Science and Technology, Rolla, MO</i>		2:25pm

THURSDAY, JUNE 20 (CONTINUED)

Coffee Break	Atrium	2:45pm - 3:10pm
BREAKOUT SESSION 5A (2hr) CEMENT CHEMISTRY (PART 2 OF 2) <i>MODERATOR: ALEX BRAND, VIRGINIA TECH</i>	Room 125	3:10pm - 5:10pm
IONIC TRANSPORT IN C-S-H/C-(N)-A-S-H/N-A-S-H NANOPORES: A MOLECULAR DYNAMICS STUDY Weiqliang Chen, Kai Gong <i>Civil and Environmental Engineering, Rice University, Houston, TX</i>		3:10pm
REACTIVITY OF CALCIUM ALUMINOSILICATE GLASSES Subhashree Panda <i>Civil & Architectural Engineering, University of Miami, Coral Gables, FL</i>		3:30pm
SCALABLE AND TRANSPORTABLE THERMOCHEMICAL ENERGY STORAGE USING CEMENTITIOUS MATERIALS Arpit Dwivedi, Paul Ginsberg, Lakshmi Amulya Nimmagadda <i>Cache Energy</i>		3:50pm
ADDRESSING COMPLICATED WASTE CHEMISTRIES IN GENERATION OF CEMENTITIOUS WASTE FORMS Matthew R. Asmussen, Suraj A. Rahmon, Sarah A. Saslow, Gary L. Smith <i>Energy & Environment Division, Pacific North West National Laboratory, Richland, WA</i>		4:10pm
UNDERSTANDING THE INFLUENCE OF ORGANIC LIGANDS ON THE FORMATION OF MAGNESIUM SILICATE HYDRATE Trinh Thao My Nguyen, Erika La Plante, Jared Ura, <i>UC Davis, Davis, CA</i>		4:30pm
EARLY-STAGE DISSOLUTION BEHAVIOR OF MGO-CLAY-BASED CEMENT Juan Pablo Gevaudan <i>Department of Architectural Engineering, Pennsylvania State University, State College, PA</i> Yi Xiang <i>Department of Materials Science & Engineering, Pennsylvania State University, University Park, PA</i>		4:50pm

ADVANCES IN CEMENT-BASED MATERIALS

JUNE 19-21, 2024

MISSOURI S&T | ROLLA, MO

THURSDAY, JUNE 20 (CONTINUED)

BREAKOUT SESSION 5B (2hr) CO ₂ UTILIZATION TOWARDS CARBON-NEUTRAL CONCRETE MODERATOR: SHIHO KAWASHIMA, COLUMBIA UNIVERSITY	Room 120	3:10pm - 5:10pm
THERE IS SOMETHING NEW UNDER THE SUN Anne M. Werner <i>Construction, Southern Illinois University Edwardsville, Edwardsville, IL</i>		3:10pm
UNVEILING BIO-MOLECULE-REGULATED ORDINARY PORTLAND CEMENT AS A CO₂ SINK: A NEW PATHWAY TO DECARBONIZE CONCRETE MANUFACTURING Monica Amaral, Xiaodong Wang <i>The University of Alabama, Tuscaloosa, AL</i> Yi Fang <i>College of Mechanics & Materials, Hohai University, Nanjing, China</i> Jialai Wang <i>Civil, Construction, & Environmental Engineering, The University of Alabama, Tuscaloosa, AL</i>		3:30pm
CARBON NEUTRAL CONCRETE WITH CO₂-SEQUESTERING BIOCHAR Julia Hylton <i>Materials Science, Colorado School of Mines, Golden, CO</i> Lori Tunstall <i>Civil & Environmental Engineering, Colorado School of Mines, Golden, CO</i>		3:50pm
USE OF AMINES FOR INTERNAL CARBONATION CURING IN CEMENTITIOUS MATERIALS Ali Ghahremaninezhad PhD, Mohammad Sadegh Tale Masoule <i>Civil, Architecture & Environmental Engineering, University of Miami, Coral Gables, FL</i>		4:10pm
CARBON-ENRICHED FLY ASH CHARACTERIZATION AND ITS EFFECT ON THE HYDRATION OF PORTLAND-LIMESTONE-CEMENT MORTARS Lisa E. Burris <i>Ohio State University</i> Michelle A. Cooper <i>Department of Transportation, Federal Highway Administration, McLean, VA</i> Erin A. Stewartson <i>Civil, Environmental, & Geodetic Engineering, The Ohio State University, Columbus, OH</i>		4:30pm
CO₂ UPTAKE IN SUPPLEMENTARY CEMENTITIOUS MATERIALS Wasiu Olaniyi Alimi, Prannoy Suraneni <i>Civil and Architectural Engineering, University of Miami, Coral Gables, FL</i>		4:50pm
DEI Event	Missouri S&T Experimental Mine	5:30pm - 6:15pm

FRIDAY, JUNE 21

PROGRAM	LOCATION	TIME
Registration & Coffee	Atrium	7:45am - 8:15am
PANEL DISCUSSION ON INDUSTRY INVOLVEMENT <i>Moderator: Prannoy Suraneni</i> <i>University of Miami</i> <i>Panelists: Matthew D'Ambrosia, Aida Margarita Ley Hernandez, Jeffrey Thomas</i>	Room 125	8:15am - 9:15am
Coffee Break	Atrium	9:15am - 9:40am
BREAKOUT SESSION 6A (2hr) SUSTAINABILITY AND SCMS (PART 3 OF 3) MODERATOR: MONDAY U. OKORONKWO, MISSOURI S&T	Room 125	9:40am - 11:40pm
EFFECT OF TEMPERATURE AND CSA DOSAGE ON THE HYDRATION KINETICS AND PHASE ASSEMBLAGE OF BLENDED OPC - CSA SYSTEMS Rachel E. Cook, Olajide Olaniyi Ipindola, Aron Newman <i>Engineering Laboratory, National Institute of Standards & Technology, Gaithersburg, MD</i> Mehdi Shokouhian <i>Civil & Environmental Engineering, Morgan State University, Baltimore, MD</i>		9:40am
INVESTIGATING THE EFFECT OF LIMESTONE AND GYPSUM IN BELITE-ENRICHED SULFOALUMINATE CEMENTS AT DIFFERENT WATER TO SOLID RATIOS Rohan R. Bhat, Taihao Han, Aditya Kumar, Sai Akshay Ponduru <i>Materials Science & Engineering, Missouri University of Science & Technology, Rolla, MO</i>		10:00am
ASSESSMENT OF HIGH-VOLUME HARVESTED FLY ASH BLENDS FOR USE IN PRECAST CONSTRUCTION Matthew J. Gombeda, Zoe N. Lallas, Kurt A. Ordillas <i>Department of Civil, Architectural & Environmental Engineering, Illinois Institute of Technology, Chicago, IL</i>		10:20am
MECHANOCHEMICAL ACTIVATION OF BASALTIC FINES FOR THE PRODUCTION OF SUPPLEMENTARY CEMENTITIOUS MATERIALS Wasiu Olaniyi Alimi, Sofiane Amroun, Luca Galli, Prannoy Suraneni <i>Civil & Architectural Engineering, University of Miami, Coral Gables, FL</i>		10:40am
CHARACTERISATION OF LIBYAN CLAYS AND THEIR POTENTIAL AS SUPPLEMENTARY CEMENTITIOUS MATERIALS Ruben Paul Borg, Ahmed Hamed <i>Faculty for the Built Environment, University of Malta, Msida, Malta</i>		11:00am
QUANTIFYING THE THIXOTROPIC BEHAVIOR OF FRESH CEMENT PASTE INFUSED WITH WASTEWATER-DERIVED STRUVITE Ugochukwu Ewuzie, Monday U. Okoronkwo <i>Chemical & Biochemical Engineering, Missouri University of Science & Technology, Rolla, MO</i>		11:20am

ADVANCES IN CEMENT-BASED MATERIALS

JUNE 19-21, 2024

MISSOURI S&T | ROLLA, MO

FRIDAY, JUNE 21 (CONTINUED)

BREAKOUT SESSION 6B (2hr) RHEOLOGY & ADDITIVE MANUFACTURING <i>MODERATOR: MARGARITA LEY, ICON</i>	Room 120	9:40am - 11:40pm
SIZE EFFECT OF 3D-PRINTED FIBER-REINFORCED CONCRETE CONSIDERING FIBER DISTRIBUTION Yucun Gu, Seongho Han, Kamal Khayat, Haodao Li <i>Missouri University of Science & Technology, Rolla, MO</i>		9:40am
FRESH AND HARDENED PROPERTIES OF 3D-PRINTED ULTRA DUCTILE ENGINEERED CEMENTITIOUS COMPOSITES Amir Bakhshi, Maryam Hojati, Muhammad Saeed Zafar <i>University of New Mexico, Albuquerque, NM</i>		10:00am
USE OF LIGNIN-BASED ADMIXTURE AS WATER REDUCER FOR TAILORING THE RHEOLOGICAL PROPERTIES OF MORTARS FOR 3D-PRINTING Anastasia N. Aday, Kyle E. O. Foster, Xavier Fross, Adewale Odukomaiya, Fabian B. Rodriguez, Rory Schmidt, <i>Building Technologies & Science Center, National Renewable Energy Laboratory, Golden, CO</i> Michael E. Himmel <i>Bioenergy Science & Technology Department, National Renewable Energy Laboratory, Golden, CO</i> Michael Griffin <i>Catalytic Process Development, National Renewable Energy Laboratory, Golden, CO</i>		10:20am
SYNERGISTIC EFFECT OF LOW-CARBON CEMENTITIOUS MATERIALS ON THE KEY PERFORMANCE OF 3D PRINTING CONCRETE Yucun Gu, Kamal Khayat <i>Missouri University of Science & Technology, Rolla, MO</i>		10:40am
DOES IT REALLY MATTER IN WHICH ORDER I MIX UHPC? Jedariah F. Burroughs <i>Geotechnical & Structures Laboratory</i> <i>U.S. Army Engineer Research & Development Center, Vicksburg, MS</i>		11:00am
INTRODUCING PARTICLE SHAPE METRIC (PSM): A FUNDAMENTAL PARAMETER THAT ENCAPSULATES ROLE OF AGGREGATE MORPHOLOGY IN ENHANCING PACKING AND PERFORMANCE Bayezid Baten <i>Civil Engineering, University of Illinois Urbana Champaign, Urbana, IL</i> Nishant Garg <i>Civil & Environmental Engineering, University of Illinois Urbana Champaign, Urbana, IL</i>		11:20am
Closing Remarks	Room 125	11:40am - 12:00pm

KEYNOTE SPEAKER: SHIHO KAWASHIMA CEMENT RHEOLOGY AND PROCESSING: WHY GIVE A CRAP



Shiho Kawashima
Associate Professor
Civil Engineering and
Engineering Mechanics
Columbia University

Although cement-based materials are in the plastic state for only a short period of time, its corresponding rheological properties are critically important to enable proper processing and placement so that the final material performs in the way it was intended to. For conventional casting methods, we have been primarily focused on flow properties. However, as 3D concrete printing has emerged as a promising method of construction, we have become more interested in the viscoelastic and elastic properties of cements while still in the fresh state. This talk will highlight some of our recent studies in this area, including understanding the role of different CaCO_3 polymorphs derived from CO_2 mineralization pathways on tailoring structural build-up behavior and capturing the time evolution of viscoelastic parameters (i.e. storage modulus and critical strain) via shear oscillatory strain sweep methods.

BIOGRAPHY:

Shiho Kawashima is an Associate Professor of Civil Engineering and Engineering Mechanics at Columbia University. Her current research interests include cement rheology, low carbon concretes, and earth-based materials. Kawashima received an NSF Career Award in 2017 and the ACerS Early Career Award in 2022. She is an active member of ACI (current Editor-in-Chief of ACI Materials Journal), ACerS (past Cements Division Chair), and RILEM. Kawashima received her B.S. in Civil Engineering at Columbia University, and her M.S. and Ph.D. in Civil Engineering at Northwestern University. She joined Columbia University as an Assistant Professor in 2013.

ABSTRACT:

Although cement-based materials are in the plastic state for only a short period of time, its corresponding rheological properties are critically important to enable proper processing and placement so that the final material performs in the way it was intended to. For conventional casting methods, we have been primarily focused on flow properties. However, as 3D concrete printing has emerged as a promising method of construction, we have become more interested in the viscoelastic and elastic properties of cements while still in the fresh state. This talk will highlight some of our recent studies in this area, including understanding the role of different CaCO_3 polymorphs derived from CO_2 mineralization pathways on tailoring structural build-up behavior and capturing the time evolution of viscoelastic parameters (i.e. storage modulus and critical strain) via shear oscillatory strain sweep methods.

DELLA ROY LECTURE: DR. MARIA JUENGER THE ROAD TO SUSTAINABLE CEMENT



Dr. Maria Juenger
L.B. (Preach) Meaders
Professor of Engineering
Fariborz Maseeh
Department of Civil,
Architectural, and
Environmental Engineering
University of Texas, Austin

ABSTRACT:

In 1987, the United Nations Brundtland Commission defined sustainability as “meeting the needs of the present without compromising the ability of future generations to meet their own needs.” This definition addresses the importance of continuing to maintain and grow infrastructure in developed and developing regions for quality of life. In 2024, the sustainability of construction, and particularly of cements, has taken on a new urgency as climate goals are becoming more ambitious and formalized. Correspondingly, we are seeing incredible growth in research and development

of green cements. In this talk, I'll explore a bit of the history of sustainable cements (including the pioneering work of Della Roy!), putting new cements in their historical and technological context. I'll discuss in more detail the sustainable cements that have been the focus of my research on over the past two decades, namely calcium sulfoaluminate belite cements, alkali-activated materials, and supplementary cementitious materials with an emphasis on synthesis, characterization, and novel applications.

BIOGRAPHY:

Dr. Maria Juenger is the L.B. (Preach) Meaders Professor of Engineering in the Fariborz Maseeh Department of Civil, Architectural, and Environmental Engineering at the University of Texas at Austin. Dr. Juenger's teaching and research focus on materials used in civil engineering applications, with an emphasis on chemical issues in cement-based materials. Dr. Juenger is a fellow of the American Concrete Institute (ACI) and the American Ceramic Society (ACerS) and currently serves as Vice President of ACI. Dr. Juenger received her B.S. degree in Chemistry and Spanish from Duke University and Ph.D. in Materials Science and Engineering from Northwestern University. After completing her Ph.D., she was a postdoctoral researcher in Civil Engineering at the University at California, Berkeley before coming to the University of Texas at Austin.

ADVANCES IN CEMENT-BASED MATERIALS

JUNE 19-21, 2024

MISSOURI S&T | ROLLA, MO

PANEL SPEAKERS



Matthew D'Ambrosia

Matthew D'Ambrosia, PhD, PE, FACI is Principal and Co-Founder of MJ2 Consulting where he specializes in solving difficult problems for the construction industry. Dr. D'Ambrosia has over 20 years of experience in concrete materials behavior and research. His interests include materials optimization for specialized applications, durability-related mechanisms such as volume change and cracking, as well as new approaches for prediction

and verification of service life and sustainability. He has expertise with large infrastructure projects throughout the world, such as tall buildings, bridges, highways, dams, and power plants. He is a Licensed Professional Engineer in thirteen states.

Dr. D'Ambrosia teaches instructional courses for the industry and is Adjunct Professor in the Department of Civil and Environmental Engineering at Northwestern University. He is a Fellow of the American Concrete Institute (FACI), where he currently serves as Chair of ACI 562J on Repair Materials and ACI 209C on Creep and Shrinkage, voting member of ACI 318A and numerous other committees. He is a member of and former Chair of the ACerS Cements Division. He received his B.S. in Civil Engineering from the University of Iowa, and M.S. and Ph.D. in Civil Engineering from University of Illinois at Urbana-Champaign.



Aida Margarita Ley Hernandez

Dr. Ley Hernandez is ICON's leading expert in developing sustainable 3D printable materials. Dr. Ley Hernandez earned her MSc in civil engineering with an emphasis on construction materials in 2016, followed by her Ph.D in civil engineering from Missouri University of Science and Technology in 2020. Her area of expertise focused on the rheological characterization of cement-based materials, workability, placement, and mechanical properties of self-consolidating concrete.



Jeffrey Thomas

Jeffrey Thomas is a Senior Principal Scientist in the Global Research Division of GCP / Saint-Gobain Construction Chemicals, where he develops new cement additives, technologies, and services related to cement and concrete. Prior to joining GCP he spent 7 years with Schlumberger doing research on oilwell cementing and 16 years doing fundamental research on cement chemistry

at Northwestern University. He recently completed a three-year term as the Trustee of the Cements Division.

POSTER SESSIONS

Abstract #3345

INSIGHTS TO THE CHARACTERISATION OF ALKALI-ACETATE BLAST FURNACE SLAG BINDERS

Yuyan Huang

Civil, Architectural & Environmental Engineering
Missouri University of Science & Technology, Rolla, MO

Susan A. Bernal, Alastair T.M. Marsh

School of Civil Engineering, University of Leeds, Leeds, United Kingdom,

Sam Adu-Amankwah

School of Engineering & Applied Science Aston University, Birmingham, United Kingdom

Abstract #3348

CHARACTERIZING CO₂ IN CEMENTITIOUS MATERIALS WITH REMOTE FIBER OPTIC RAMAN PROBE

Hongyan Ma, Mohammad Azimi Pour

Department of Civil, Architectural, & Environmental Engineering
Missouri University of Science and Technology, Rolla, MO

Abstract #3187

INCREASING THE REACTIVITY OF ABUNDANTLY AVAILABLE BASALT FOR SUSTAINABLE CEMENTS: EARTH AND BEYOND

Sophia Liron Bergen

Department of Civil & Environmental Engineering, Princeton University, Princeton, NJ

Claire E. White

Department of Civil & Environmental Engineering, and the
Andlinger Center for Energy & the Environment, Princeton University, Princeton, NJ

Abstract #3234

ELUCIDATING THE REACTION KINETICS AND MECHANISMS IN SODIUM CARBONATE-ACTIVATED HIGH-VOLUME BLENDED CEMENT

Kai Gong, Samira Hossain

Civil & Environmental Engineering, Rice University, Houston, TX

Abstract #3281

RHEOLOGY, 3D PRINTING, AND PARTICLE INTERACTIONS OF XANTHAN GUM-CLAY BINDER FOR EARTH CONCRETE.

Shiho Kawashima

Columbia University

Yierfan Maierdan

Civil Engineering & Engineering Mechanics, Columbia University, New York, NY

Abstract #3212

IMPACT OF CALCINED CLAYS ON RHEOLOGY AND MECHANICAL PERFORMANCE OF CEMENTITIOUS SYSTEMS

Nishant Garg

Civil & Environmental Engineering, University of Illinois Urbana Champaign, Urbana, IL

Muhammad Farjad Iqbal

University of Illinois Urbana Champaign, Urbana, IL

Abstract #3130

PROBING MECHANICAL PROPERTIES OF CARBONATION PRODUCTS IN REACTIVE MGO CEMENT USING HIGH-PRESSURE X-RAY DIFFRACTION.

Jiaqi Li, Ruoxi Yang

Lawrence Livermore National Laboratory, Livermore, CA

Abstract #3233

INSIGHTS ON CLAY CALCINATION VIA IN-SITU TEM

Tausif E. Elahi, Nishant Garg, Pablo Romero

Civil & Environmental Engineering, University of Illinois Urbana Champaign, Urbana, IL

Abstract #3252

ROLE OF CRYSTALLINITY AND AL-CONTENTS ON THE DECALCIFICATION RESISTANCE OF C-S-H AND C-A-S-H

Warda Ashraf, Ishrat Baki Borno

Civil Engineering, The University of Texas at Arlington, Arlington, TX

Muhammad Intesarul Haque

HNTB Corporation, Baltimore, MD

Abstract #3303

EFFECT OF CELLULOSE NANO-FIBER GELS ON THE CHLORIDE INGRESS AND FREEZE/THAW PROPERTIES OF CEMENTITIOUS PASTE

Alexander S. Brand

Civil & Environmental Engineering, Virginia Tech, Blacksburg, VA

Md Hasibul Hasan Rahat

Department of Civil & Environmental Engineering, Virginia Tech, Blacksburg, VA

Abstract #3152

HIGH TEMPERATURE AND PRESSURE MOLECULAR DYNAMICS SIMULATIONS OF SODIUM-ALUMINO-SILICATE-HYDRATE GEL

Yangwoo Lee

Civil & Environmental Engineering, Princeton University, Princeton, NJ

Claire E. White

Department of Civil & Environmental Engineering, and the
Andlinger Center for Energy & the Environment, Princeton University, Princeton, NJ

Abstract #3253

THE SYNERGY BETWEEN CO₂ AND SEAWATER CURING OF CALCIUM SILICATE-BASED CEMENTITIOUS COMPOSITES

Warda Ashraf, Ishrat Baki Borno, Farzana Mustari Nishat

Civil Engineering, The University of Texas at Arlington, Arlington, TX

Abstract #3309

CHLORELLESTADITE: A NOVEL CARBONATABLE BINDER

Mohamed Abdelrahman

University of Illinois, Urbana-Champaign, Champaign, IL

Nishant Garg, Vikram Kumar

Civil & Environmental Engineering, University of Illinois Urbana Champaign, Urbana, IL

Abstract #3315

AN INVESTIGATION INTO THE SUITABILITY OF PALM KERNEL SHELL BIOCHAR FOR USE AS AN ALTERNATIVE FINE AGGREGATE IN THE PRODUCTION OF CONVENTIONAL PORTLAND CEMENT CONCRETES

Alex O. Aning, Tristan J. Pagkalinawan

Materials Science & Engineering
Virginia Polytechnic Institute & State University, Blacksburg, VA

14TH ANNUAL

ADVANCES IN CEMENT-BASED MATERIALS

JUNE 19-21, 2024

MISSOURI S&T | ROLLA, MO

POSTER SESSIONS (CONTINUED)

Abstract #3328

ALKALI-SILICA REACTION MECHANISM IN LIME-POZZOLANA MORTAR

Warda Ashraf, Ishrat Baki Borno

Civil Engineering, The University of Texas at Arlington, Arlington, TX

Adhora Tahsin

Department of Civil Engineering, The University of Texas at Arlington, Arlington, TX

Abstract #3146

TOWARD ONE-PART ALKALI-ACTIVATED METAKAOLIN VIA INTER-GRINDING: ASSESSING THE EFFECTS OF INTER-GRINDING ON REACTION KINETICS AND MICROSTRUCTURE

Meddelin Setiawan, Claire E. White

Department of Civil & Environmental Engineering, and the Andlinger Center for Energy and Environment, Princeton University, Princeton, NJ

Abstract #3202

INFLUENCE OF PH VARIATION ON YE'ELIMITE EARLY-AGE HYDRATION KINETICS AND MICROSTRUCTURE DEVELOPMENT

Godwin I. Ogbuehi, Monday U. Okoronkwo

Chemical & Biochemical Engineering
Missouri University of Science & Technology, Rolla, MO

Abstract #3265

HYDROGELS AS INTERNAL CURING AGENTS: INTERACTIONS WITH CEMENTITIOUS MIXTURES FROM THE LAB TO THE FIELD

Kendra A. Erk, Akul Nimish Seshadri

School of Materials Engineering, Purdue University, West Lafayette, IN

Chibueze Sylvester Ajuonuma, Jan Olek Dr

Lyles School of Civil Engineering, Purdue University, West Lafayette, IN

Abstract #3317

EFFECT OF BOVINE AND FISH BONE AS A PARTIAL REPLACEMENT OF FINE AGGREGATE IN MORTAR MIXTURES

Lamiya Noor

University of Colorado Boulder, Boulder, CO

Wil V. Srubar, III

Civil, Environmental, & Architectural Engineering
University of Colorado Boulder, Boulder, CO

Abstract #3171

PERMEABILITY OF ENZYMATIC CONCRETE

Shuai Wang

Enzymatic,inc, Las Vegas, NV

Abstract #3106

PRINTABILITY OF MODIFIED CEMENT-BASED MATERIALS AND REVIEWING ITS MECHANICAL PROPERTIES AT VARYING LAYER THICKNESS

Mursaleen Shahid

Industrial Engineering, UNITN, Trento, Italy

Abstract #3256

USING POLYMER SCIENCE TO IMPROVE CONCRETE PRINTING: FOAM GELS, MICROGELS, AND SHAMPOO

Yuan-Jung Chen, AlaEddin Douba, Kendra A. Erk,

Matthew Kaboolian, Angus Moore, Andre Ponsot,

School of Materials Engineering, Purdue University, West Lafayette, IN

Abstract #3173

A SELF-HEALING ENZYMATIC CONSTRUCTION MATERIAL

Shuai Wang

Enzymatic,inc, Las Vegas, NV

Abstract #3319

3D-PRINTABLE, SUSTAINABLE CONCRETE ALTERNATIVE USING CLAY AND BIOPOLYMER ADDITIVES

Samuel J. Armistead, Wil V. Srubar, III

Civil, Environmental, and Architectural Engineering, University of Colorado, Boulder

Rebecca A. Mikofsky

Materials Science and Engineering Program, University of Colorado, Boulder

Abstract #3244

UNLOCKING CONCRETE'S GREEN POTENTIAL: INTEGRATING SUPPLEMENTARY CEMENTITIOUS MATERIALS WITH BIOMOLECULE-REGULATED CARBONATION FOR DEEP DECARBONIZATION

Abdulmalik Alawode, Monica Amaral, Maysam Bahmani,

Xi Chen, Maria Idrees, Xiaodong Wang

The University of Alabama, Tuscaloosa, AL

Jialai Wang

Civil, Construction, & Environmental Engineering
The University of Alabama, Tuscaloosa, AL

Abstract #3324

HYDRATION & MICROSTRUCTURAL EVOLUTION OF SEAWATER-MIXED CALCIUM ALUMINATE CEMENT

Rachel E. Cook, Olajide Olaniyi Ipindola

Engineering Laboratory, National Institute of Standards & Technology, Gaithersburg, MD

Curtis Martin

Naval Surface Warfare Center, Carderock Division, Bethesda

Stephanie Moffitt

Physical Measurement Laboratory

National Institute of Standards & Technology, Gaithersburg, MD

Mehdi Shokouhian

Civil and Environmental Engineering, Morgan State University, Baltimore, MD

Abstract #3155

COMPRESSIVE STRENGTH PREDICTION OF FREEZE-THAW DAMAGED CONCRETE USING HYPERSPECTRAL IMAGING AND DATA-DRIVEN METHODS

Kangyi Cai, Genda Chen, Rezwana Binte Hafiz, Hongyan Ma, Pengfei Ma

Department of Civil, Architectural, & Environmental Engineering
Missouri University of Science and Technology, Rolla, MO

Abstract # 3351

BIOWASTE AS SUSTAINABLE SUPPLEMENTARY CEMENTITIOUS MATERIALS IN PORTLAND CEMENT CONCRETE

Beng Wei Chong, Amlan Majumder, Xihun Shi

Civil Engineering, Ingram School of Engineering, Texas State University, San Marcos, TX

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STUDENT HOUSING

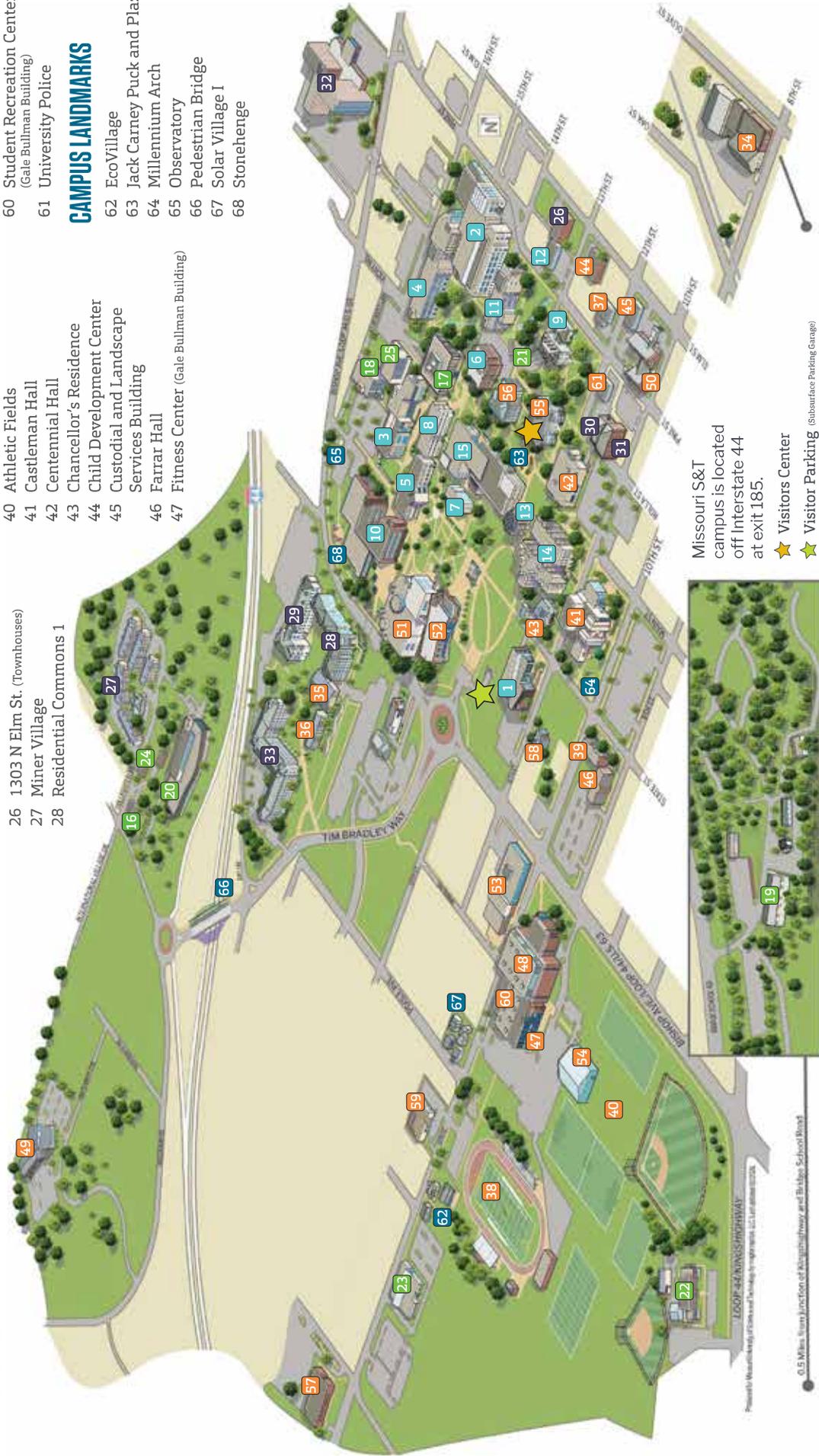
- 26 1303 N Elm St. (Townhouses)
- 27 Miner Village
- 28 Residential Commons 1

CAMPUS/STUDENT SUPPORT

- 29 Residential Commons 2
- 30 Rolla Suites Building 1
- 31 Rolla Suites Building 2 (Department of Residential Life)
- 32 Thomas Jefferson Residence Hall
- 33 University Commons
- 34 209 E. 8th St. (Printing and Mail Services, North Warehouse, and South Warehouse)
- 35 710 W. Tim Bradley Way
- 36 800 W. Tim Bradley Way
- 37 1200 N. Pine St.
- 38 Allgood-Bailey Stadium
- 39 Altman Hall
- 40 Athletic Fields
- 41 Castleman Hall
- 42 Centennial Hall
- 43 Chancellor's Residence
- 44 Child Development Center
- 45 Custodial and Landscape Services Building
- 46 Farrar Hall
- 47 Fitness Center (Gale Bullman Building)

CAMPUS LANDMARKS

- 48 Gale Bullman Building
- 49 General Services Building
- 50 Hasselmann Alumni House (Miner Alumni Association)
- 51 Havener Center
- 52 Innovation Lab
- 53 Kummer Student Design Center
- 54 Miner Dome Indoor Practice Facility
- 55 Norwood Hall
- 56 Parker Hall
- 57 Phelps Health Annex
- 58 Student Diversity Initiatives Center
- 59 Student Health Complex
- 60 Student Recreation Center (Gale Bullman Building)
- 61 University Police
- 62 EcoVillage
- 63 Jack Carney Puck and Plaza
- 64 Millennium Arch
- 65 Observatory
- 66 Pedestrian Bridge
- 67 Solar Village I
- 68 Stonehenge



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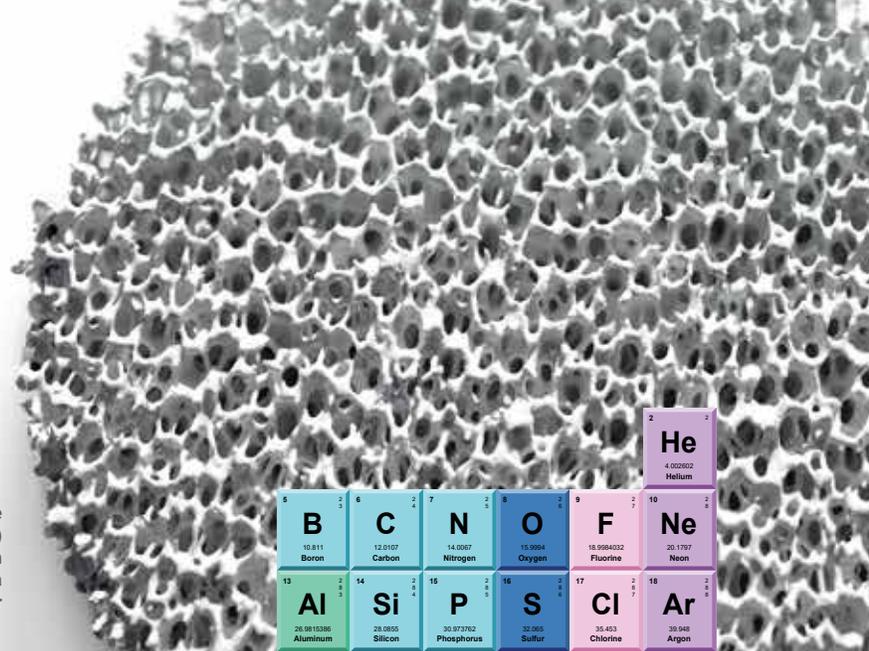


Photo: Ceramic sponge (nanoscale morphology) produced from American Elements proprietary ultra high surface area powder

1 H 1.00794 Hydrogen																	2 He 4.002602 Helium																												
3 Li 6.941 Lithium	4 Be 9.012182 Beryllium											5 B 10.811 Boron	6 C 12.0107 Carbon	7 N 14.0067 Nitrogen	8 O 15.9994 Oxygen	9 F 18.9984032 Fluorine	10 Ne 20.1797 Neon																												
11 Na 22.98976928 Sodium	12 Mg 24.305 Magnesium											13 Al 26.9815386 Aluminum	14 Si 28.0855 Silicon	15 P 30.973762 Phosphorus	16 S 32.065 Sulfur	17 Cl 35.453 Chlorine	18 Ar 39.948 Argon																												
19 K 39.0983 Potassium	20 Ca 40.078 Calcium	21 Sc 44.955912 Scandium	22 Ti 47.867 Titanium	23 V 50.9415 Vanadium	24 Cr 51.9961 Chromium	25 Mn 54.938045 Manganese	26 Fe 55.845 Iron	27 Co 58.933195 Cobalt	28 Ni 58.6934 Nickel	29 Cu 63.546 Copper	30 Zn 65.38 Zinc	31 Ga 69.723 Gallium	32 Ge 72.64 Germanium	33 As 74.9216 Arsenic	34 Se 78.96 Selenium	35 Br 79.904 Bromine	36 Kr 83.796 Krypton																												
37 Rb 85.4678 Rubidium	38 Sr 87.62 Strontium	39 Y 88.90585 Yttrium	40 Zr 91.224 Zirconium	41 Nb 92.90638 Niobium	42 Mo 95.96 Molybdenum	43 Tc 98.0 Technetium	44 Ru 101.07 Ruthenium	45 Rh 102.9055 Rhodium	46 Pd 106.42 Palladium	47 Ag 107.8682 Silver	48 Cd 112.411 Cadmium	49 In 114.818 Indium	50 Sn 118.71 Tin	51 Sb 121.76 Antimony	52 Te 127.6 Tellurium	53 I 126.90447 Iodine	54 Xe 131.293 Xenon																												
55 Cs 132.9054 Cesium	56 Ba 137.327 Barium	57 La 138.90547 Lanthanum	72 Hf 178.48 Hafnium	73 Ta 180.94788 Tantalum	74 W 183.84 Tungsten	75 Re 186.207 Rhenium	76 Os 190.23 Osmium	77 Ir 192.217 Iridium	78 Pt 195.084 Platinum	79 Au 196.966569 Gold	80 Hg 200.59 Mercury	81 Tl 204.3833 Thallium	82 Pb 207.2 Lead	83 Bi 208.9804 Bismuth	84 Po (209) Polonium	85 At (210) Astatine	86 Rn (222) Radon																												
87 Fr (223) Francium	88 Ra (226) Radium	89 Ac (227) Actinium	104 Rf (261) Rutherfordium	105 Db (262) Dubnium	106 Sg (263) Seaborgium	107 Bh (264) Bohrium	108 Hs (265) Hassium	109 Mt (266) Meitnerium	110 Ds (267) Darmstadtium	111 Rg (268) Roentgenium	112 Cn (269) Copernicium	113 Nh (270) Nihonium	114 Fl (285) Flerovium	115 Mc (286) Moscovium	116 Lv (287) Livermorium	117 Ts (294) Tennessine	118 Og (294) Oganesson																												
<table border="1"> <tr> <td>58 Ce 140.116 Cerium</td> <td>59 Pr 140.90765 Praseodymium</td> <td>60 Nd 144.242 Neodymium</td> <td>61 Pm (145) Promethium</td> <td>62 Sm 150.36 Samarium</td> <td>63 Eu 151.964 Europium</td> <td>64 Gd 157.25 Gadolinium</td> <td>65 Tb 158.92535 Terbium</td> <td>66 Dy 162.5 Dysprosium</td> <td>67 Ho 164.93032 Holmium</td> <td>68 Er 167.259 Erbium</td> <td>69 Tm 168.93421 Thulium</td> <td>70 Yb 173.054 Ytterbium</td> <td>71 Lu 174.9668 Lutetium</td> </tr> <tr> <td>90 Th 232.03806 Thorium</td> <td>91 Pa 231.03688 Protactinium</td> <td>92 U 238.02891 Uranium</td> <td>93 Np (237) Neptunium</td> <td>94 Pu (244) Plutonium</td> <td>95 Am (243) Americium</td> <td>96 Cm (247) Curium</td> <td>97 Bk (247) Berkelium</td> <td>98 Cf (251) Californium</td> <td>99 Es (252) Einsteinium</td> <td>100 Fm (257) Fermium</td> <td>101 Md (258) Mendelevium</td> <td>102 No (259) Nobelium</td> <td>103 Lr (262) Lawrencium</td> </tr> </table>																		58 Ce 140.116 Cerium	59 Pr 140.90765 Praseodymium	60 Nd 144.242 Neodymium	61 Pm (145) Promethium	62 Sm 150.36 Samarium	63 Eu 151.964 Europium	64 Gd 157.25 Gadolinium	65 Tb 158.92535 Terbium	66 Dy 162.5 Dysprosium	67 Ho 164.93032 Holmium	68 Er 167.259 Erbium	69 Tm 168.93421 Thulium	70 Yb 173.054 Ytterbium	71 Lu 174.9668 Lutetium	90 Th 232.03806 Thorium	91 Pa 231.03688 Protactinium	92 U 238.02891 Uranium	93 Np (237) Neptunium	94 Pu (244) Plutonium	95 Am (243) Americium	96 Cm (247) Curium	97 Bk (247) Berkelium	98 Cf (251) Californium	99 Es (252) Einsteinium	100 Fm (257) Fermium	101 Md (258) Mendelevium	102 No (259) Nobelium	103 Lr (262) Lawrencium
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