

Christopher R. Shearer, Ph.D.

Assistant Professor

Department of Civil and Environmental Engineering

South Dakota School of Mines and Technology

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EDUCATION

Georgia Institute of Technology, Atlanta, GA

Ph.D. in Civil Engineering, 2014

Minor: Sustainable Structural Materials

Doctoral Advisor: Kimberly Kurtis

Dissertation Title: *The productive reuse of coal, biomass and co-fired fly ash*

M.S. in Civil Engineering, 2009

Focus: Structural Engineering

Ohio Northern University, Ada, OH

B.S. in Civil Engineering with High Distinction, 2008

Minor: Business Administration

PROFESSIONAL EXPERIENCE

Assistant Professor, South Dakota School of Mines and Technology, Rapid City, SD, Aug. 2014–present

Research interests include the multi-scale study of the chemical, physical, and mechanical properties and durability performance of infrastructure materials, with a focus on sustainable concrete materials technology.

Structural Engineer, URS Corporation, Cleveland, OH, May 2007–Sept. 2007, May 2008–Aug. 2008

Designed aspects of the concrete foundations and steel frames for multiple power plants around the U.S. Developed a girt-truss system design guide to support components and cladding for buildings.

Engineering Intern, Ohio Department of Transportation, Cleveland, OH, May 2006–Sept. 2006

Inspected a bridge construction and road repavement project, and managed finances for all concrete and asphalt materials.

RESEARCH EXPERIENCE

Research Assistant and Department of Energy Office of Science Graduate Research Fellow, Civil Engineering, Georgia Institute of Technology, 2009–2014

Conducted research on the potential reuses of biomass co-fired fly ash in concrete and geopolymers using analytical techniques including SEM, TGA/DTA, ICP-OES, BET surface area, XRD, XRF, petrography, and calorimetry among others, and a suite of ASTM Standards testing.

Guest Researcher, Oak Ridge National Laboratory, Oak Ridge, TN, 2014

Investigated the structural features formed in alkali-silica reaction gel using the extended Q-range small-angle neutron scattering diffractometer (EQ-SANS) at the Spallation Neutron Source (SNS).

Guest Researcher, National Institute of Standards and Technology, Gaithersburg, MD, 2013

Assessed the rheological behavior of alkali-activated geopolymer gels and cement pastes by measuring and modeling shear stress-shear rate curves.

Advanced Light Source User, Lawrence Berkeley National Laboratory, Berkeley, CA, 2012-2013

Performed X-ray absorption near edge structure (XANES) analyses on biomass co-fired fly ash and geopolymers to generate spatially-resolved elemental images and to determine chemical speciation using three X-ray microscopes: BL 5.3.2.2, 5.3.2.1, and 10.3.2.

National Science Foundation East Asia & Pacific Summer Institutes Fellow, University of Melbourne, Australia, 2011

Research Mentors: John Provis and Susan Bernal

Developed alkali-activated biomass co-fired fly ash geopolymers and used FTIR, TMA, and XRD to characterize fundamental properties of these lab-produced specimens.

TEACHING EXPERIENCE

Advanced Concrete Materials (CEE 792), Instructor, SDSM&T, Fall 2014

Structural Analysis I (CEE 3055), Instructor, Georgia Tech, Summer 2014

Civil Engineering Materials (CEE 3020), Teaching Assistant, Georgia Tech, 2008-2009

REFEREED JOURNAL ARTICLES

- 1) **Shearer, C.R.**, Kurtis, K.E., *Use of Biomass and Co-Fired Fly Ash in Concrete*, ACI Materials Journal, Vol. 111, 2014, DOI: 10.14359/51686827.
- 2) Yeboah, N.N.N., **Shearer, C.R.**, Burns, S.E., Kurtis, K.E., *Characterization of Biomass and High Carbon Content Coal Ash for Productive Reuse Applications*, Fuel, Vol. 116, January 2014, pp. 438-447. <http://dx.doi.org/10.1016/j.fuel.2013.08.030>

JOURNAL ARTICLES IN PREPARATION

- 1) **Shearer, C.R.**, Provis, J.L., Bernal, S.A., Kurtis, K.E., *The Use of Biomass-Coal Co-fired Fly Ash as a Geopolymer Precursor*, in preparation.
- 2) **Shearer, C.R.**, Yeboah, N.N.N., Kurtis, K.E., *XANES Microscopy Study on Raw and Alkali-Activated Biomass and Co-fired Fly Ash*, in preparation.

REFEREED CONFERENCE PUBLICATIONS

- 1) **Shearer, C.R.**, Provis, J.L., Bernal, S.A., Kurtis, K.E., *Characterisation of Alkali-activated Co-fired Fly Ash Geopolymers*, Proceedings of the Concrete in the Low Carbon Era International Conference, Dundee, UK, 2012.
- 2) **Shearer, C.R.**, Yeboah, N.N.N., Burns, S.E., Kurtis, K.E., *Evaluation of Biomass Fired and Co-fired Fly Ash for Alkali-Silica Reaction Mitigation in Concrete*, Proceedings of the 14th International Conference on Alkali-Aggregate Reaction, Austin, TX, 2012.

NON-REFEREED CONFERENCE PUBLICATIONS

- 1) **Shearer, C.R.**, Yeboah, N.N.N., Kurtis, K.E., Burns, S.E., *The Early Age Behavior of Biomass Fired and Co-fired Fly Ash in Concrete*, Proceedings of World of Coal Ash Conference, Denver, CO, 2011.
- 2) **Shearer, C.R.**, Yeboah, N.N.N., Kurtis, K.E., Burns, S.E., *Investigation of biomass co-fired fly ash properties: Characterization and concrete durability performance*, Proceedings of the Second International Conference on Sustainable Construction Materials and Technologies, Ancona, Italy, 2010.

TECHNICAL REPORTS

- 1) **Shearer, C.R.**, and Kurtis, K.E., *The Productive Reuse of Coal, Co-fired and Biomass Fly Ash as a Supplementary Cementitious Material in Concrete*, Southern Company, Atlanta, GA, 2012.

INVITED PRESENTATIONS

- 1) *The Productive Reuse of Biomass Ash and Co-fired Fly Ash in Concrete and Alkali-Activated Geopolymers*, National Institute of Standards and Technology, Gaithersburg, MD, March 26, 2013.
- 2) *An Overview of the European Standard EN 450*, ASTM Committee C-09 on Concrete and Concrete Aggregates Meeting, New Orleans, LA, Dec. 6-8, 2010.

CONFERENCE PRESENTATIONS

- 1) *Development of Sustainable Infrastructure Materials*, South Dakota Engineering Society Fall Conference, South Dakota School of Mines and Technology, Rapid City, SD, Oct. 9, 2014.
- 2) *The Pozzolan Reactivity of Biomass and Co-fired Fly Ash*, American Concrete Institute Fall 2013 Convention, Phoenix, AZ, Oct. 20-24, 2013.
- 3) *Rheological Study on Coal Fly Ash Geopolymeric Pastes*, The American Ceramic Society 4th Advances in Cement-based Materials Conference, University of Illinois at Urbana-Champaign, Urbana, IL, July 8-10, 2013.
- 4) *Characterisation of Alkali-activated Co-fired Fly Ash Geopolymers*, Concrete in the Low Carbon Era Conference, University of Dundee, Dundee, UK, Aug. 9-11, 2012.
- 5) *Co-fired fly ash as a precursor for geopolymer production*, The American Ceramic Society 3rd Advances in Cement-based Materials Conference, University of Texas at Austin, Austin, TX, June 10-12, 2012.
- 6) *Evaluation of Biomass Fired and Co-fired Fly Ash for Alkali-Silica Reaction Mitigation in Concrete*, 14th International Conference on Alkali-Aggregate Reaction, Austin, TX, May 20-25, 2012.
- 7) *Synthesis and Analysis of Co-fired Fly Ash Geopolymers*, EAPSI Debriefing Session, Sydney, Australia, July 29, 2011.
- 8) *The Early Age Behavior of Biomass Fired and Co-fired Fly Ash in Concrete*, World of Coal Ash, Denver, CO, May 9-12, 2011.
- 9) *Investigation of biomass co-fired fly ash properties: Characterization and concrete durability performance*, Second International Conference on Sustainable Construction Materials and Technologies, Ancona, Italy, June 28-30, 2010.
- 10) *Design for a Swinging Bridge on the Buckeye Trail's Miami and Erie Canal Towpath*, ASCE Structures Congress, Austin, TX, April 30-May 2, 2009.

CONFERENCE POSTERS

- 1) *Look out cement, there's a new concrete in town*, DOE SCFG Annual Research Meeting, Brookhaven National Laboratory, Upton, NY, July, 2012.
- 2) *Characterization of Co-fired Fly Ash Geopolymers*, Georgia Tech Research and Innovation Conference, Atlanta, GA, Feb. 7, 2012.
- 3) *Characteristics and Potential Uses of Combustion Products Derived from Biomass Co-firing with Coal*, Georgia Tech Research and Innovation Conference, Atlanta, GA, Feb. 8, 2011.
- 4) *Characterization and Chemical Admixture Interaction of Biomass Co-fired Fly Ash*, The American Ceramic Society Advances in Cement-based Materials Conference, Purdue University, West Lafayette, IN, June 11-13, 2010.

- 5) *Characteristics and Potential Uses of Combustion Products Derived from Biomass Firing and Co-firing*, Lafarge International Workshop on Materials for Sustainable Construction, Atlanta, GA, May 4-8, 2009.

AWARDS AND HONORS

- Department of Energy Office of Science Graduate Fellowship, 2010-2013
- Georgia Tech President's Fellowship, 2008-2013
- American Concrete Institute Presidents' Fellowship, 2010-2011
- National Science Foundation East Asia & Pacific Summer Institutes (EAPSI) Award, University of Melbourne, Australia, 2011
- World of Coal Ash Student Presentation Award, Denver, CO, 2011
- Georgia Tech Research & Innovation Conference Poster Award, Atlanta, GA, 2011
- The American Ceramic Society Student Poster Award, Advances in Cement-based Materials Conference, Purdue University, 2010
- American Concrete Institute Scholarship, 2009-2010
- First Place, American Society of Civil Engineers Structural Engineering Institute, Student Design Award, 2009
- Tau Beta Pi Fellowship – Fife Fellow, 2008-2009
- Ohio Northern University Presidential Merit Scholarship, 2004-2008
- Tau Beta Pi Scholarship, 2007-2008
- Washington Group International Scholarship, 2007-2008
- Ohio Northern University Recognition Medal – Highest Ranking Graduate in the College of Engineering, 2008
- Remsburg Award – Most Innovative Senior Design Project, Ohio Northern University, 2008
- American Society of Civil Engineers Outstanding Project Leader Award, Ohio Northern University, 2008

STUDENT ADVISING

Michael Dollarhide, undergraduate research assistant, SDSM&T, 2014-present

Ten undergraduate research assistants, Georgia Tech, 2010-2013

CONSULTING EXPERIENCE

TEC Services, Inc., Atlanta, GA, March 2014-July 2014
Tested the pozzolanicity of a waste material using TGA.

Metna Co., Atlanta, GA, May 2013-Oct. 2013
Analyzed the early-age reaction kinetics of high-performance cementitious mixtures.

Geosyntec Consultants, Atlanta, GA, Aug. 2012-Oct. 2012
Performed SEM imaging and XRD analysis to investigate the self-hydrating properties of fly ash.

Grace Construction Products, Atlanta, GA, April 2010-Sept. 2010
Conducted a systematic testing series on the sulfate resistance of cement mortars.

PROFESSIONAL ACTIVITIES

Member

American Society for Engineering Education, since 2012

The American Ceramic Society, since 2010

American Concrete Institute, since 2008

Earthquake Engineering Research Institute, since 2008

Vice President, Georgia Tech Chapter, 2011

Tau Beta Pi (Engineering Honor Society), since 2006

Joint Engineering Council Representative, Ohio Northern University Chapter, 2007

American Society of Civil Engineers, since 2004

Vice President, Ohio Northern University Chapter, 2007

Secretary, Ohio Northern University Chapter, 2006

Project Manager, Ohio Northern University Concrete Canoe Team, 2008

Mix Engineer, Ohio Northern University Concrete Canoe Team, 2007

Administrative Engineer, Ohio Northern University Concrete Canoe Team, 2006

Committee Member, ASCE Regional Conference, 2005

Journal Reviewer

Materials and Structures, 2014

Journal of Materials in Civil Engineering (ASCE), 2012-2014

UNIVERSITY SERVICE

Concrete Canoe Team Faculty Advisor, SDSM&T, 2014-present

Recruitment: SDSM&T, 2014-present

CEE Faculty Search Committee, SDSM&T, 2014-2015

Center for the Enhancement of Teaching and Learning Orientation Panel Member, Georgia Tech,
2012

OUTREACH SERVICE

K-12 Civil Engineering Presentations, 2010-present

Science at Hand Day, Fernbank Museum of Natural History, Atlanta, GA, 2010-2012

NSF Science, Technology, Engineering, and Mathematics Talent Expansion Program (STEP),
Atlanta, GA, 2010

CERTIFICATIONS

Engineer in Training (E.I.T.), Ohio Professional Engineers and Surveyors Board, 2008