BIOGRAPHICAL SKETCH

Babajide Onanuga is a born Lagosian and grew up in Lagos as a typical "Lagos-Boy". After graduating with his BS degree from the University of Lagos, in 2009, he proceeded to complete his mandatory one-year national assignment in Megastrat Consulting Limited (MCL), where he was exposed to business process re-engineering (BRP), as well as supervisory roles – coordinating training programs. As a regular volunteer, Babajide served his community in many capacities including academic tutoring and mentoring for more than 5 years and served as the vice-president of a "charity" group at Eti-Osa local government during his one-year national youth service (NYSC) assignment in 2010, mobilizing donations to orphanage homes among others during this period. From 2012 to 2016, before beginning his postgraduate studies at Tennessee Tech, Babajide also worked in Diamond Bank PLC in Nigeria as a product analyst in a product management role in charge of the retail auto-loans of the bank; and was able to increase the auto-loans asset portfolio of the bank by over 300 % during this period.

EDUCATION

Ph.D. Engineering
Tennessee Tech University, 2016-2022 (expected)

M.S. in Chemical Engineering
Tennessee Tech University, 2016-2020

B.Sc. in Chemical Engineering
University of Lagos, 2004-2009

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College of Engineering

TENNESSEE TECH

The Department of

Chemical Engineering

Announces the Dissertation Defense of

Babajide Yusuf Onanuga

In Partial

Fulfillment of the Requirements

For the degree of

Doctor of Philosophy in Engineering

20th July 2022

10:00 AM

Held in

Prescott 204

Tennessee Tech University

Zoom Link:

https://us04web.zoom.us/j/75117938230?pwd=aoSEpVxS2FsrgyiZZPMl775GSK80vX.1

FIELD OF STUDY

Chemical Engineering

DISSERTATION TOPIC

The Time-Dependent Rheology of Portland Cement-Based Printing Pastes

EXAMINING COMMITTEE

Dr. Joseph J. Biernacki (Chairperson)

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Dr. Holly Stretz

Dr. Ismail Fidan

Dr. Craig Henderson

*Dr. Benjamin Mohr

*Presiding for Dr. Henderson at the defense.

ABSTRACT

The future of infrastructure construction lies at the doorstep of the widespread adoption of additive manufacturing technologies. And, while additive manufacturing is a maturing field for polymeric and metallurgical materials, a pathway for cement-based systems is yet unclear. While numerous challenges and unanswered questions hinder the full adoption of this technology in construction, material-related challenges which require extrudability and flowability (rheology) of printed materials is key. Specifically, the lack of understanding of the time-dependent rheological evolution of cement-based printing paste materials, within the context of the printing time frame, is one of the many factors that play a role in the rate and success of commercial adoption. This thesis aims to bridge this gap and sets-up in three parts: (1) understand the important factors – physical and chemical – that control the rheological evolution of cement-based materials, (2) develop a mathematical framework for predicting and controlling the rheological properties of cement-based materials and (3) explore the effect of printing process parameters on the performance of rheologically modified cement-based printing materials.

Part 1 – This work focused on understanding the effect of shear history and apparent measures of particle dispersion on the time-dependent flow-rheology behavior of cement in different dispersants while comparing pastes of hydrating cement to that of non-hydrating silicon carbide paste.

Part 2 –This research developed a two-mechanism model that captures the complex time-dependent rheology of cement paste and reproduces the experimentally observed thixotropic to anti-thixotropic transitions in cement paste under cyclical flow conditions.

Part 3 – This work developed a process-stable robust additive manufacturing process using a suitable hydrogel admixture – HEMC – as a printing aid for cement paste printing. The printing performance of two cement-hydrogel pastes was studied using statistical analysis of the printed objects.