Durable Concrete for Infrastructure under Severe Conditions

Smart Admixtures, Self-responsiveness and Nano-additions

GHENT UNIVERSITY

Final Program

LORCENIS

10-11 September 2019

Het Pand, Ghent, Belgium

Welcome by the Lorcenis project coordinator

The International **Conference on Durable Concrete for Infrastructure under Severe Conditions – smart admixtures, self-responsiveness and nano-additions** is organised in the framework of the European project LORCENIS, whose the main focus has been long lasting concrete for a new generation of energy infrastructures. New infrastructure projects for energy or transport require long service life spans, which often exceed those formulated in standards. Durable materials are vital for safety and functionality of structures, and therefore their service life. Existing and emerging energy technologies require materials that perform in more and more extreme operating conditions as they are installed in sub-arctic/arctic areas (low temperatures, ice-abrasion), desert areas (high temperatures), along coast lines (high chloride contents), deep-sea or underground (large temperature gradients and high pressure). At the same time, our society has to face environmental aspects caused by increased CO_2 emissions. New energy technologies are necessary to meet the energy request from carbon-based sources more efficiently at short term and to move to renewable energy sources at a longer term. The concept of LORCENIS is based on the implementation of new multifunctional self-responsive strategies in concrete materials under severe operating conditions, supported by numerical tools to capture the multi-scale evolution of damage and models for service life prediction. On behalf of the Consortium of partners in LORCENIS, it is my great pleasure to welcome you in this conference. Let us take the opportunity to learn from the talks presented during the conference and meet new colleagues.

Christian Simon

Welcome by the conference organizers

The continuously growing world population and wide-spread industrialization increase the need for sustainable infrastructure. The construction industry currently is responsible for an important part of the environmental impacts related to the use of natural resources and energy, the production of waste, and greenhouse gas emissions. To minimize these impacts, our civil engineering structures need to become more long-lasting and smart. Since concrete is the most used construction material, increasing the durability of concrete structures is an important goal in this respect. To obtain such enhanced durability and sustainability, in the last decade several smart admixtures have been developed to impart self-responsiveness to this material, including self-sensing, selfcuring, and self-healing. Carbon nanofibers and nanotubes have been used to make the concrete self-sensing and report when damage is about to occur or has occurred already. Layered double hydroxides can capture aggressive agents intruding into the concrete and can release corrosion inhibitors to prevent damage. Superabsorbent polymers have been developed to provoke internal curing and hence can mitigate autogenous shrinkage cracks; they can also self-seal cracks from intruding liquids and stimulate self-healing through the deposition of calcium carbonate and binder hydration products. Micro- and macro-capsules containing mineral or polymeric healing agents can provide autonomic self-healing properties.
With this conference we want to offer participants a full overview of the most recent advances in the development of these smart admixtures. The compatibility of the smart admixtures with other concrete components and the effects on fresh and hardened concrete properties are considered. Modelling of the hydration reactions and microstructure formation in the novel durable concrete, of the activation of smart properties, of the service life in specific environments, and of environmental impacts, is of importance as well. Existing and emerging energy technologies also require that these materials perform in more and more extreme operating conditions as they are installed in sub-arctic/arctic areas (low temperatures, ice-abrasion), desert areas (high temperatures), along coast lines (high chloride contents), deep-sea or underground (large temperature gradients and high pressure). Evaluation of the resistance to extreme conditions is also included.

We hope that you will enjoy this opportunity to share your latest experiences, to discover new avenues for exploration, to meet colleagues, and of course to enjoy the beautiful historic city of Ghent.

Nele De Belie, Kim Van Tittelboom, Sandra Van Vlierberghe, Adelaide Araújo, Laurence De Meyst

Conference Information

REGISTRATION DESK
The registration desk is located at the entrance of *Het Pand*. Registration is recommended on Tuesday 10 September 2019 between 08:00 – 09:00.

CONFERENCE PROCEEDINGS
Papers of all oral and poster presentations as well as the papers of the keynote speakers are included in the USB drive.

CONFERENCE PROGRAM
In case a speaker is missing, the time schedule of the presentations will not be changed! We have some extra presentations to fill the gaps. In case there is no more extra presentation, we will wait for 15 minutes.

BADGES
Please wear your badge during the conference. All delegates have a white badge. The members of the organizing committee can be recognized by their yellow badge.

EMERGENCIES
In case of emergency, the conference secretariat can be reached during the conference on phone number (+32) (0)474 87 87 75.

INTERNET
Make a wireless connection with "UGentGuest". If you have set up to request an IP address automatically, you will receive an IP address starting with 193.190.8x.
Now you are connected, but not yet authenticated. You should start a webbrowser and you will be redirected to a logon screen. If not surf to http://www.ugent.be. Enter the username and password.

Login: guestLorcen
Password: 2mCQPrbn

After correct authentication you can use the Internet connection.
Your connection to this wireless LAN is not encrypted. To protect your personal data, please use encrypted connections like https, imaps, ssh etc. or a VPN client.
You're not allowed to pass on the login information to others.

CONFERENCE DINNER
The conference dinner will take place on Tuesday 10 September 2019 at 19:00 in ‘Het Monasterium.
Adress: Oude Houtlei 56 – 9000 Ghent

PUBLIC TRANSPORT
Bus time tables: http://www.delijn.be
Train time tables: http://www.railtime.be

TAXI
Phone numbers:
Vtax: +32 9 222 22 22
TaxiGent: +32 9 333 33 33

Guidelines for Speakers

UPLOADING OF PRESENTATIONS
Presentations saved as pptx / ppt or pdf are allowed. Presentations (saved on a USB memory stick) must be uploaded on the computers next to the registration desk in *Het Pand* during breaks and lunches. Members of the organizing committee will assist speakers to upload the presentations and to preview their presentations. It will not be possible to use personal laptop computers for presentations.

LECTURE
Please go to the session room at least 10 minutes before your session starts. You can introduce yourself to the session Chair. You can familiarize yourself with the room and the audio/video equipment. Each lecture takes 15 minutes (except for keynote lectures: 30 minutes). Please give your presentation strictly within 12 minutes, so that 3 minutes are left for questions. Keynote lectures can take 25 minutes, so that 5 minutes are left for questions.

Guidelines for Posters

POSTERS
The format of the posters is A0. Posters have to be placed on Tuesday morning (8:00 – 9:00) on the poster panels in the room *Kapittelzaal*. The number of your poster can be found in the program for poster presentations, so please fix your poster at the panel with the corresponding number. Members of the organizing committee will be in the room to assist you to hang your poster. No adhesive tape can be used to fix the posters! Posters stay at the panels from Tuesday morning till Wednesday. In that way, participants have the possibility to look at the posters during the whole conference. Please do not forget to pick up your poster after the closing session.

POSTER SESSION
The poster session will take place during the coffee break on Tuesday (15:15-16:00)

Conference Program

Topics/Abbreviations

S1: Development of smart admixtures with active internal curing, self-sealing or self-healing properties
S2: Design of reinforced concrete tailored for extreme conditions - compatibility of smart admixtures and effects on fresh and hardened concrete
S3: Modelling and service life prediction of concrete in extreme conditions
S4: Durability of infrastructure in the energy sector; durability and sustainability of tailor-made concrete in extreme conditions

K Keynote lecture (25' presentation + 5' discussion)
O Oral presentation (12' presentation + 3' discussion)
P Poster presentation

DAY 1 | Tuesday, 10 September 2019

8:00-9:00	Registration	
Room **REFTER**		
9:00-9:10	Welcome & opening | Nele **DE BELIE**	
9:10-9:30	General overview Lorcenis project | Christian **SIMON**	
Chair Christian Simon		
9:30-10:00	**S1-K1** | Smart admixtures with active functionality | Ioannis **KARTSONAKIS**	
10:00-10:15	**S1-O01** | Effect of reactive MgO expansive agent on self-healing of strain hardening cement-based composites cracks | Yuqing **DAI**	
10:15-10:30	**S1-O02** | Use of alkali-activated cementitious materials as impressed current cathodic protection anodes for long-term structural health | Graeme **JONES**	
10:30-10:45	COFFEE BREAK	
10:45-11:00	**S1-O03** | The development of SAPs for reducing autogenous shrinkage and accomplishing self-healing and self-sealing properties in concrete | Els **MANNEKENS**	
11:00-11:15	**S1-O04** | The Development of Mini-Vascular Networks for Self-Healing Concrete | Diana **GARDNER**	
11:15-11:30	**S1-O05** | Textile-reinforced concrete to realise ultra high durability concrete (UHDC) in the framework of the EU H2020 project "ReSHEALience" | Christof **SCHRÖFL**	
11:30-11:45	**S1-O06** | Modification of POSS derivatives for reinforcement of bulk concrete | Monika **PILZ**	
11:45-12:00	**S1-O07** | The use of self-healing sodium silicate microcapsules in oil well cement under high-temperature wellbore environment | Chrysoula **LITINA**	
12:00-12:30	**S2-K2** | Multifunctional bulk reinforced-concrete materials to operate under severe conditions | Emmanuel **GALLUCCI**	
12:30-13:30	LUNCH	
	Room **REFTER**	Room **AUGUST VERMEYLEN**
	Chair Emmanuel Galluci	Chair Jose Vera Agullo
13:30-13:45	**S2-O01** | Use of superabsorbent polymers to mitigate autogenous shrinkage in ultra-high performance concrete | Laurence **DE MEYST**	**S4-O01** | Use of embedded chemical sensors to monitor the ingress of aggressive agents from the environment into concrete | Rui **SAMPAIO**
13:45-14:00	**S2-O02** | The effect of POSS and SAP additives on self-healing of cracks in concrete for hydropower applications | Peter **LUNDQVIST**	**S4-O02** | Ice abrasion resistance in high performance concrete engineered with smart admixtures | Kjell **Tore**

14:00-14:15	**S2-O03** | Effect of layered double hydroxides on the performance and service life of reinforced concrete | Celestino **GOMES**	**S4-O03** | Durability evaluation of concrete for high temperature applications under thermal fatigue | Javier **PUENTES**
14:15-14:30	**S2-O04** | Strengthening of the dutch waal bridge by high-performance reinforced concrete 'Xposal' | Frans **HOKSBERGEN**	**S4-O04** | Impact of super absorbent polymers on early age behavior of ultra-High performance concrete walls | Judy **KHEIR**
14:30-14:45	**S2-O05** | 3D Printing of cementitious materials with superabsorbent polymers | Kim **VAN TITTELBOOM**	**S4-O05** | Durable concrete for infrastructure with high performance binders | Dirk **QVAESCHNING**
14:45-15:00	**S2-O06** | Severe sulfuric acid attack on self-compacting concrete: from the mineralogical characterization to durability properties | Sara **IRICO**	**S4-O06** | Characterizing the fatigue behavior of high-performance concrete for wind energy structures | Vivian **FREI**
15:00-15:15	**S2-O07** | Durability of acrylic latex and silica fume modified cement mortar under harsh circumstances | Sukanta **SHILL**	**S4-O07** | The CO_2 sequestration ability and carbonation resistance of slag-blended cement mortar containing γ-dicalcium silicate | Zhengxin **CHEN**
15:15-16:00	COFFEE BREAK + **POSTER SESSION**	
Room **REFTER**		
Chair Kim Van Tittelboom		
16:00-16:30	**S4-K3** | Durability of concrete infrastructure and the role of smart self-responsiveness admixtures | Jose Vera **AGULLO**	
16:30-16:45	**S2-O08** | Mechanism analysis of calcium sulfoaluminate cement resistance to sulfate attack | Wei **HOU**	
16:45-17:00	**S2-O09** | Analysis of the compressive fatigue loading of ultra-high strength grouts and influence of the aggregate nature on the fatigue life | Erisa **MYRTJA**	
17:00-17:15	**S2-O10** | Evaluation of freeze thaw performance of GGBS concrete | Tahsin **YIKICI**	
17:15-17:30	**S2-O11** | Efficacy of different crystalline admixtures in self-healing capacity of fibre reinforced concrete | Evangelia **TSAMPALI**	
17:30-17:45	**S2-O12** | Mitigating freeze/thaw damage to concrete through use of microencapsulated phase change materials | Branko **ŠAVIJA**	
19:00	Conference Dinner | **MONASTERIUM** (Oude Houtlei 56)	

Posters

P01 | Detection of concrete cracking through voltammetric sensors | A. Martínez **IBERNÓN**

P02 | Chlorides penetration forecast by means of ionic resistance value | A. Martínez **IBERNÓN**

P03 | Durability of reinforced concrete structures under simultaneous flexural load in corrosive environment | Loukas **KARAVOKYROS**

P04 | Passive layer destruction detection. Accumulated charge curve analysis | J.R. Lliso **FERRANDO**

P05 | Chloride binding capacity and chloride diffusion coefficient of Portland cement mortar blended with high alumina cement and calcium carbonate | Yunsu **LEE**

P06 | Self-healing cracks in concretes at early ages with crystalline admixtures | Vanessa **CAPPELLESSO**

DAY 2 | Wednesday, 11 September 2019

Room REFTER	
Chairs Monika Pilz and Daniel Hoeche	
8:30-9:00	**S3-K4** | Providing structural engineers with a tool for the design of concrete coverage | Philippe **MAINÇON**
9:00-9:15	**S3-O01** | An overview on the numerical modelling of "self-protection" processes in concrete: application to layered double hydroxides | Zahid **MIR**
9:15-9:30	**S3-O02** | Effect of real climatic conditions on freeze-thaw induced damage of concrete | Charlotte T**HIEL**
9:30-9:45	**S3-O03** | Taking into account climatic data in the modelling of the thermal behaviour of concrete under freeze-thaw cycles | Sara **AL HAJ SLEIMAN**
9:45-10:00	**S3-O04** | Insights from periodic DFT calculations on the structure of, and chloride incursion into, calcium-silicate-hydroxide | Ingeborg-Helene **SVENUM**
10:00-10:15	**S3-O05** | A performance-based design approach for durability design of concrete structures in acidic environments | Jesko **GERLACH**
10:15-10:45	COFFEE BREAK
10:45-11:15	**S3-K5** | Experimental and numerical study of a vascular self-healing system for cementitious materials | Anthony **JEFFERSON**
11:15-11:30	**S2-O13** | Self-healing phenomena evaluation in concretes with permeability reducing admixtures | Josue **ARNDT**
11:30-11:45	**S2-O14** | Durable and sustainable reinforced concretes obtained through the combination of calcium sulfoaluminate cement-based concretes and non-corrosive reinforcements | Federica **BERTOLA**
11:45-12:00	**S2-O15** | Properties of concrete using treated low-class recycled coarse aggregate and blast furnace slag sand | Yuji **MIYAZAKI**
12:00-12:15	**S2-O16** | Self-healing approach on early age cracked concretes with smart admixture | Vanessa **CAPPELLESSO**
12:15-12:30	**S2-O17** | Behaviour of pre-cracked self-healing cementitious materials under repeated flexural loads | Giovanni **ANGLANI**
12:30-13:30	LUNCH
Chair Philippe Mainçon	
13:30-13:45	**S4-O08** | Concept of ultra high durability concrete for improved durability in chemical environments: preliminary results | Estefania **CUENCA**
13:45-14:00	**S4-O09** | Ice abrasion testing of HP concrete for offshore structures | Stefan **JACOBSEN**
14:00-14:15	**S4-O10** | Frost testing of HP/HVFA concrete for severe offshore conditions | Andrei **SHPAK**
14:15-14:30	**S4-O11** | The impact of carbonation on frost salt scaling of concrete with ground granulated blast-furnace slag | Hanne **VANOUTRIVE**
14:30-14:45	**S4-O12** | Local electrochemical characterization – A novel approach to study initiation of chloride induced corrosion in reinforced concrete structure | Lucas **MICHEL**
14:45-15:00	**S4-O13** | Durability properties and compressive strength of high volume slag and high volume slag-fly ash blended concretes containing nano silica | Anwar **HOSAN**
15:00-15:15	**S4-O14** | Durability of concrete under combined action of leaching and freeze-thaw processes | Maria Cruz **ALONSO**
15:15-15:45	COFFEE BREAK
Chair Ioannis Kartsonakis	
15:45-16:15	**S4-K6** | Safety and sustainability of new admixtures for durable concrete | Nadia **AL-AYISH**
16:15-15:30	**S4-O15** | Durability performance of Fibre Engineered Cementitious Materials (FECM) with slurry lime (SL) addition | Calin **MIRCEA**
16:30-16:45	**S4-O16** | Experiences gained from condition assessment and service life prediction of a marine concrete structure: practice versus theory | Joost **GULIKERS**
16:45-17:00	**S4-O17** | The effect of alkali to fly ash ratio on the durability of geopolymer mortar against the coupled actions of chemicals and high thermal cycles | Sukanta **SHILL**
17:00	**Farewell drink**