



Durable Concrete for Infrastructure under Severe Conditions

Smart Admixtures,
Self-responsiveness and Nano-additions



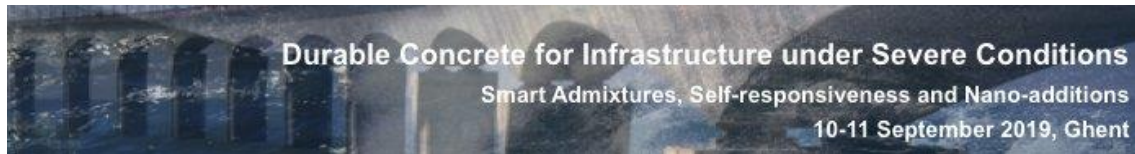
Final Program

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 CO₂ 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, self-curing, 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 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

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 Miquel PIETRO

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 Maria STEFANIDOU	
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	
Chair Monika Pilz	
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 THIEL
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 Deividi da SILVA
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
16:15-16:30	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