

HEALTH MONITORING OF STRUCTURES

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Longer service life of concrete structures is more and more required to follow sustainable construction principles. Especially in very aggressive environments, where new concrete compositions and designs are needed; besides, energy infrastructures in many cases, like offshore, need to operate in extreme environmental conditions. The health monitoring of these structures can help to identify through real-time data collection the detection of the appearance of damage, its severity and the diagnosis of structure conditions that will contribute to more accurate service life prediction.

The structure health monitoring considers the implementation to smart new technologies and sensors in concrete, as: Fiber optic, fiber brag grating sensors, piezoelectric sensors, electrochemical sensors, wireless sensing and self-sensing concrete. Through these technologies the monitor of key structural performance parameters is possible: Pressure, strain, humidity, temperature, concrete chemical properties, rebar corrosion risk, self-sensing properties.

Health monitoring of concrete structures
Main Functions:
 1) Damage detection
 2) Identification of damage location
 3) Severity of the damage
 4) Evaluation of the health status
 5) Service life prediction
 6) Real time data collection and diagnosis of structural conditions

Implementation of a smart damage diagnosis system

Response parameters for structure health monitoring → Data analyses → Reducing structural response & damage → Intelligent structure

W. Gililewski, CEM-Fing, 2015

[VIEW THE FULL VIDEO PRESENTATION](#)**SITE MONITORING TO PROVE EXTREME DURABILITY**

E. CAMACHO (SPAIN), SME RESEARCH & DEVELOPMENT CONCRETES, (RESHEALIENCE PARTNER)

The implementation of new materials as an alternative, has the difficulty of lacking experiences that contrast and generate trust in the end user. Against this background, RDC is committed to the development of resilient and durable structures with fewer resources. In order to acquire this confidence, it is necessary to invest and contrast experiences that demonstrate the performance in pilots of structures with design criteria based on durability and with more economical alternatives from a sustainable point of view as well. RDC presented two case studies of continuous monitoring of structures of various uses, as opposed to traditional solutions with conventional concretes.

Advanced Concrete truss

Steel truss

Real cost per m² of Footbridge, commercialized during lifespan

Year	Concrete Footbridge	Steel Footbridge
2012	~3500	~4500
2013	~4000	~4500
2014	~4500	~4500
2015	~4500	~4500
2016	~4500	~4500
2017	~4500	~4500
2018	~4500	~4500
2019	~4500	~4500
2020	~4500	~4500

[VIEW THE FULL VIDEO PRESENTATION](#)**NEW MATERIALS FOR SELF-DIAGNOSIS IN CONSTRUCTION**

A. KORZHENKO (FRANCE), ARKEMA, (PROFILE: IND)

Future expectances from product production to market introduction and application.

Graphistrength® C W3-2.5 liquid CNT dispersion for Concrete and Ceramics admixtures

The combination of Polycarboxylate based superplasticizers with CNT
 Compatible with most of PCE and Lignin-sulphonate based admixtures

CNT reinforcement function is specially important in the interfaces

Any negative impact on water reduction and plastisizing properties of the admixtures.

Commercially available in 1T IBC

[VIEW THE FULL VIDEO PRESENTATION](#)**ACTIVE CONTRIBUTING TECHNOLOGIES IN THE FIELD OF DURABILITY**

R. GARCIA (SPAIN), SIKA, (PROFILE: IND)

Technologies already available ready to mitigate and increase durable features, focusing in supplementary cementitious additions and nanoparticles. The durability of concrete structures is related to three stages of the cement hydration process: dissolution-nucleation-growth. Understanding the process is the way to improve durability. The incorporation of additives can vary the hydration processes and the formation of the microstructure modifying the properties of the concrete. Through the study of the combined use of additions such as nanosilica and metakaolin in concrete, as opposed to a conventional concrete, the importance of modifying the characteristics of concrete as a consequence of the variation of the formation of the microstructures and the characterization through different tests was shown. The study establishes the importance of understanding hydration mechanisms to optimise the design of mixtures, the development of test methods and applied techniques to evaluate and improve durability and service life.

MAIN STAGES DURING HYDRATION OF CEMENT (III):

Model cement
 Model cement
 Temperature admixtures
 Temperature admixtures

Slump life → Strength development

seconds minutes hours → days

III

[VIEW THE FULL VIDEO PRESENTATION](#)**EXPECTANCES FROM INTERNAL CURING IN CONCRETE**

M. FRANCINI, S. IRICO (ITALY), BUZZI UNICEM, DYCKERHOFF, (PROFILE: IND)

Cement and concrete supplier point of view and practical experience on concrete curing and other concrete topics which could require self-responsive admixtures.

EXPECTANCES FROM INTERNAL CURING IN CONCRETE

A positive example based on curing

Cuneo Monge Plant - the largest monolithic foundation cast (9,000 m²) was covered for three weeks with a layer of 50mm water.

[VIEW THE FULL VIDEO PRESENTATION](#)**EXPECTANCES FROM SELF-PROTECTION SYSTEMS**

F. MAIA (PORTUGAL), SMALLMATEK, (LORCENIS PARTNER, SME), R&D DIRECTOR OF SMALLMATEK

Layered double hydroxide (LDH) is one of the most expected additives for self-protection properties in concrete. The objective of this additive is the reduction or suppression of carbonation, chloride diffusion and corrosion. Thanks to its structure and versatility, LDH clay can be combined with corrosion inhibiting materials that act when the pores and cracks of the concrete allow the penetration of water and aggressive agents. The mechanism of action is to trap the aggressive agents through the capture and again generate a balance of the system. The development of the technology at this time is focused on the size of the particles, the effect on the setting kinetic by Zinc effect (Zn). The positive aspect in the incorporation of the material to the market to take into account is the possibility of reducing maintenance costs and increasing the service life of the structures with a multifunctional additive for self-protection purposes.

Action mechanism

Concrete

Cracks and pores (way in to chlorides and carbonates)

Aggressive species (e.g. chlorides/carbonates)

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