LORCENIS

LOng Lasting Reinforced Concrete for ENergy Infrastructure under Severe Operating Conditions

What?

The main goal of the LORCENIS project is to develop long lasting reinforced concrete for energy infrastructures under severe operating conditions with lifetime extended up to a 100%.

Why?

As population is steadily growing, there will be an **increasing demand for energy** worldwide in the coming 30 years. New infrastructure projects for energy require long service life spans (up to 100 year), even under **extreme operating conditions** like acid attack, chloride attack etc. However, conventional concretes are not able to withstand these severe conditions, leading to **high maintenance costs** and even **failure** of the construction.

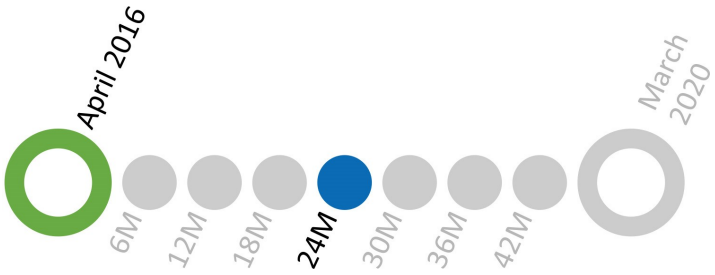
Workshop on Corrosion of Steel in Contrete

University of Aveiro, Portugal
17-18, September 2018

https://www.sintef.no/projectweb/lorcenis/workshop/

How?

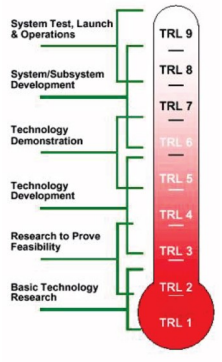
1. Development of multi-responsive **nano-materials** based on 4 technology groups (self-sensing, internal curing, self-sealing and self-healing)
2. Incorporation of the nano-additives into the **concrete**, resulting in **tailored properties** and improved performance of the final bulk reinforced-concrete working under severe conditions.
3. Development of advanced multi-scale (from atom- to macroscale) software for **modelling** and **end-of-life prediction** of the tailored reinforced concretes under the severe condition of chloride ingress.



Progress at month 24

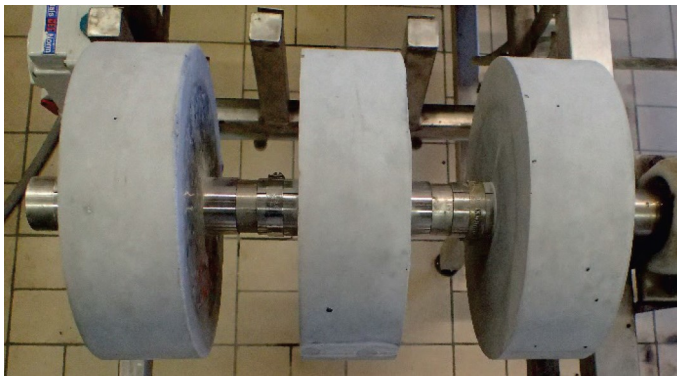
By M24, the consortium of LORCENIS reached the mid-term of the project period and could successfully pass all three critical decision stages aiming at achieving truly industrial implementation of the most promising technologies:

- Availability of self-responsive materials for incorporation into concrete with focus on TRL 3-5.
- Set of stable concrete formulations containing self-responsive materials verified at TRL 4-5.
- Selection of the most promising technologies for demonstration activities at TRL 5-7.

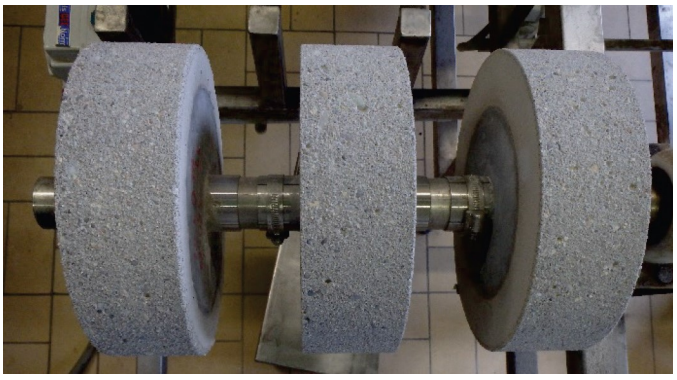


During the last reporting period (M19-M24), all **WP2** partners were demanded to supply selected self-responsive nano-additives to WP3 partners in required amounts (kilogram-scale) to complete the specimen preparation of reinforced concrete structures in WP3. Additional evaluation on improving the upscale-protocols for pre-industrial material production was necessary depending on the maturity of established lab-scale procedures.

In **WP3**, all partners involved started to monitor the behavior of the multi-responsive LORCENIS additives based on the four technology groups in concrete (self-curing, diagnosis, healing and protection) during laboratory durability testing and study the performance in comparison with reference specimens. The multifunctional admixtures were incorporated in bulk SCC & UHPC mix designs preserving the main fresh and hardening properties of the concrete formulations within the severe environment requirements.



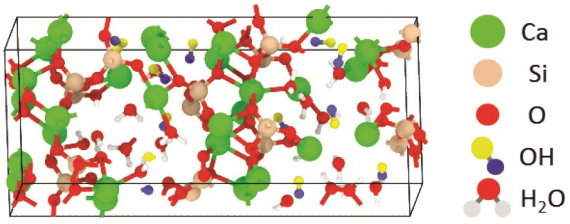
before acid attack



after acid attack

The **WP4** partners are about to finalize the several modelling approaches computationally describing the different scales that are assigned with the degradation phenomena of chloride ingress. The next step is to link these into a full chain (multiscale) predictive modelling towards service-life prediction of reinforced concretes in severe environments.

Experimental results from electrochemical response of steel in concrete are essential for realistic data input.



WP5 launched the strategy of prototype designs to be built including field exposure sites to be realised in the second part of LORCENIS to demonstrate the selected LORCENIS solutions of durable concrete for energy infrastructure under severe operating conditions.

WP6 established a comprehensive life cycle inventory on the developed LORCENIS admixtures to assess the environmental impacts and costs from cradle to grave for designing cost effective solutions. Life-Cycle Cost Analysis will be applied to evaluate the economic impact of the advanced concretes compared to traditional mixtures.

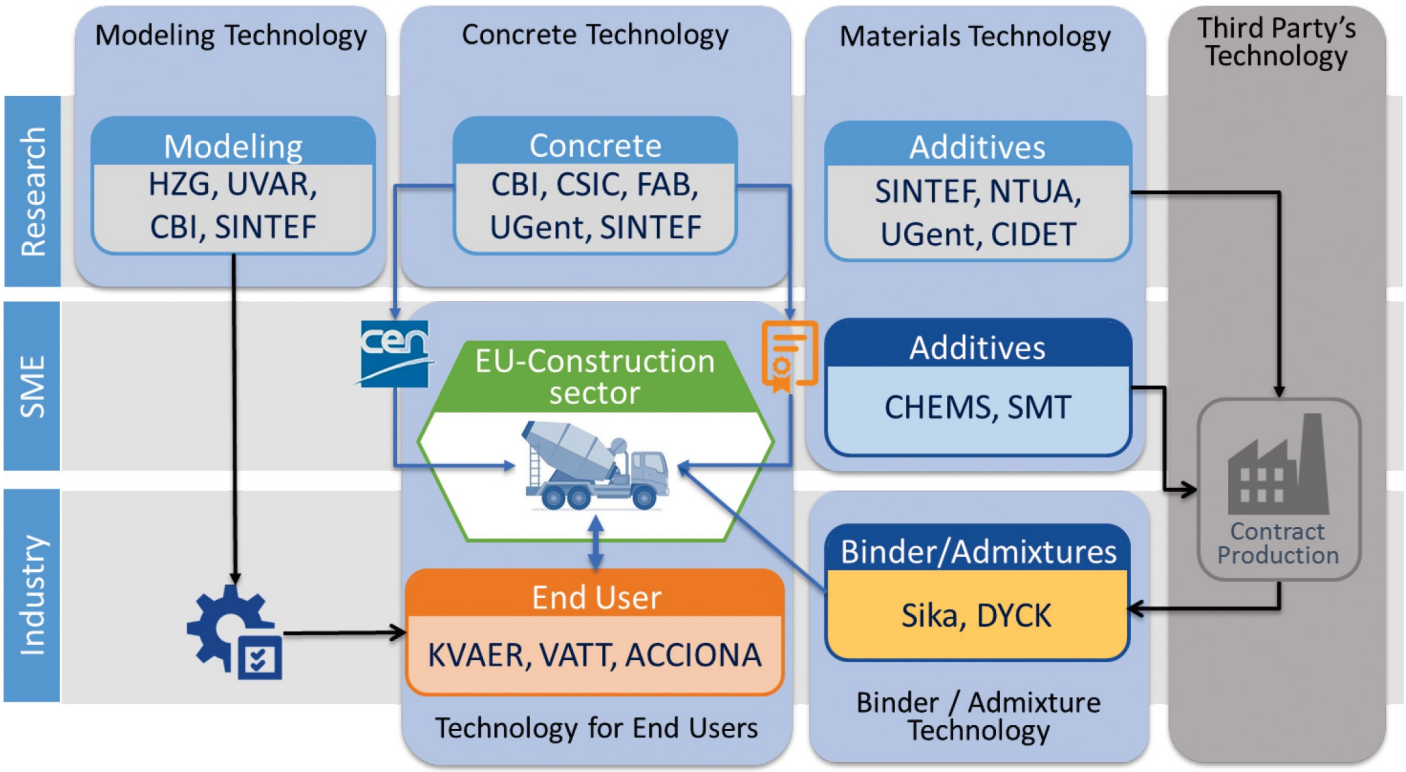
In **WP7**, the awareness and dissemination plan and the data management plan (DMP) and the plan for the Exploitation and Dissemination of Results (PEDR) are periodically updated. At M24, all partners have defined the strategy on how to exploit their key results (KER).

The Advisory Board (AB) with invited experts on energy sector infrastructures will review the progress of LORCENIS in M30.

Expected final results and potential impacts

LORCENIS project aims at addressing this European infrastructure construction and maintenance challenge through the development of new added value products and predictive tools to increase their efficiency and performance in severe operating conditions.

LORCENIS will add value to the European manufacturing sector on new added value products and manufacturing processes on reinforced concrete energy infrastructure through their adaptation to global competitiveness pressure by improving their technological base. It will be achieved by a well-balanced Consortium, well targeted value chain representation (product manufacturers, tool developers, energy infrastructure contractor and operators) as well as the project approach to new business development according to market needs, expected market up-take and standardization, safety and environmental requirements and needs tackled.



By M24, a variety of **optimized nano-additives** capable of providing both internal curing, self-sealing and self-healing and self-diagnosis functionalities and compatible with the concrete matrix were produced.

Developing cement and concrete related nanotechnology have a sustained and important impact on the future of the construction industry enabling entirely new applications for concrete.

LORCENIS aims to overcome any risks originating from missing knowledge or regulations and uncertainties relating to health and environmental issues arising from the use of manufactured nanomaterials. A **risk assessment** tool is applied to reduce potential risks from particulate nanomaterials by safe handling and control of exposure. A step-by-step approach to safe handling of all nanomaterials in all circumstances, specific best practice guides is proposed (SbD – decision tree).

Liaisons with external experts from **NanoSafety-Cluster** have already been established during the first months of the project in order to take care on safety and health aspects of new admixtures. Consequently, LORCENIS project is registered in NanoSafety Compendium List since 2016.

NanoSafety Cluster

Dissemination and Exploitation

Different partners aim at the **dissemination and exploitation** of the research results within the project related to the knowledge acquired from the nano-structured materials used as reinforcing elements in cement/concrete. Project outcomes are disseminated through publication of scientific papers in peer reviewed journals, conference presentations and posters. Keep yourself updated on the recently published results by click on the external LORCENIS website (www.lorcenis-eu.com), where also the LORCENIS Newsletters are biannually being released.

The public LORCENIS workshop related to corrosion in concrete organized by partner UAVR will take place in Aveiro in September 2018.

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Registration:

Send an e-mail to Alexandre Bastos (acbastos@ua.pt) with your name, Institution and stating which days you wish to attend: day 1, day 2 or days 1+2.

(Labs on first day afternoon limited to 20).

Contact

Project leader: Christian Simon

Email: Christian.R.Simon@sintef.no

Phone: +47 93811275

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