

RILEM 2011





RILEM

International Union of Laboratories and Experts in
Construction Materials, Systems and Structures,

Réunion **I**nternationale des **L**aboratoires et **E**xperts
des **M**atériaux, systèmes de construction et ouvrages

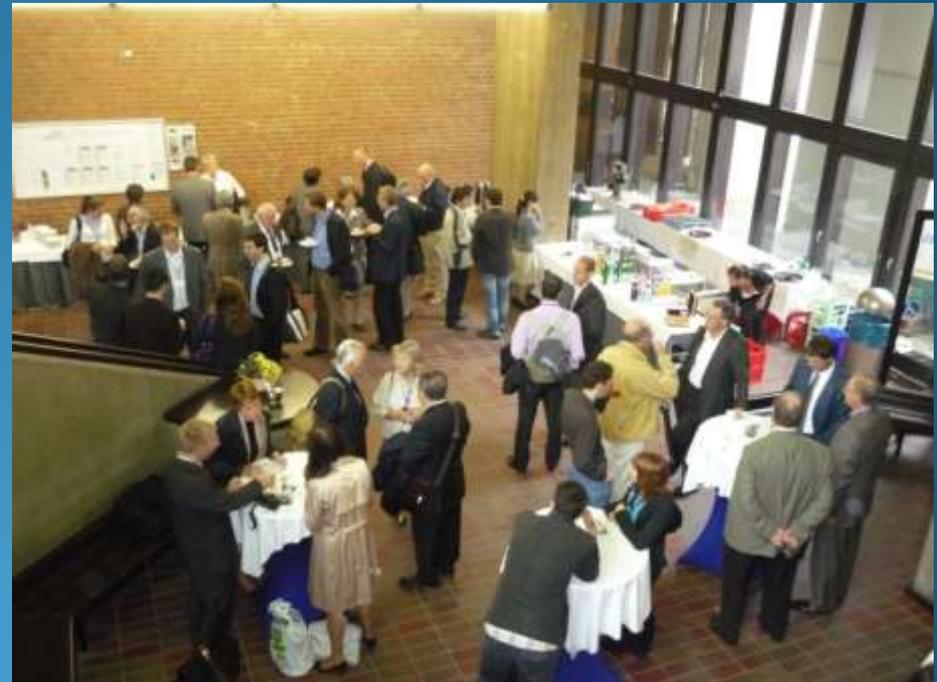
Foundation: June 1947

Objective: to promote the scientific exchange of
information between experts world- wide



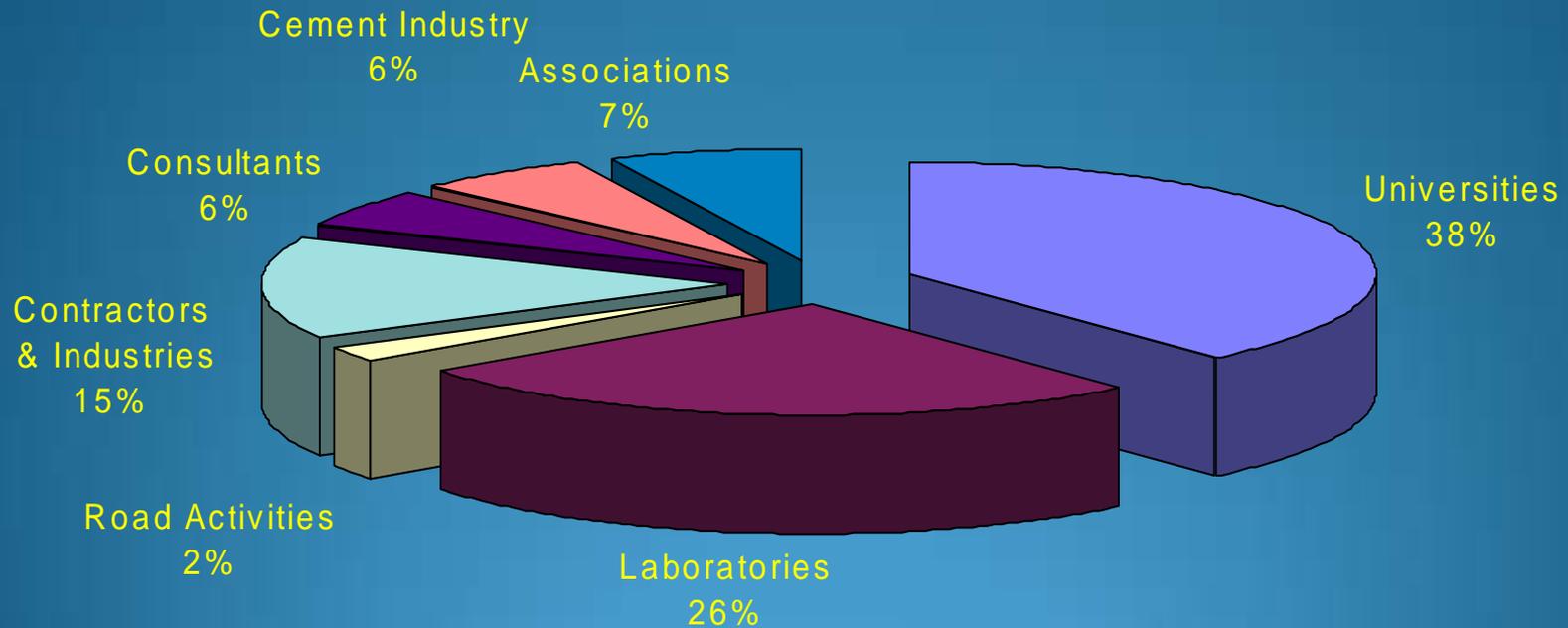
An international network of technical experts advancing the knowledge in materials and structures

- More than 1350 experts involved
- More than 800 members active in our Technical Committees (TC)





RILEM Membership



Professional Affiliation



Meetings and Technical Exchanges



- RILEM Annual Week
 - 2011 Hong Kong
 - 2012 Cape Town
 - 2013 Paris
 - 2014 Sao Paulo
(in combination with
13 DBMC)



Meetings and Technical Exchanges



- RILEM Annual Week
- International RILEM events: workshops, seminars, conferences
- Technical Committees (TC) meetings
- PhD's workshops



Producing the know-how

Technical Committees work typically results in:

- Recommendations on test methods
- State-of-the-art report on the subject treated by the TC





Scope of Technical Committees

- Mechanical Performance and Fracture
- Test Methods, Materials Characterization and Processing
- Service Life and Design
- Durability and Deterioration Mechanisms
- Bitumen, Masonry and Timber





More than 35 Technical Committees

- These committees are organized in 5 Clusters:
 - Cluster A (Convener: Prof. Wolfgang Brameshuber): Mechanical Performance and Fracture
 - Cluster B (Convener: Dr. Nicolas Roussel): Test Methods, Materials Characterization and Processing
 - Cluster C (Convener: Prof. Lars-Olof Nilsson): Service Life and Design
 - Cluster D (Convener: Prof. Nele de Belie): Durability and Deterioration Mechanisms
 - Cluster E (Convener: Prof. Manfred N. Partl): Bitumen, Masonry and Timber



- 6 new TCs approved in 2011

- TC MCD (Cluster E): Mechanisms of cracking and debonding in asphalt and composite pavements
Chair: Prof. William G. Buttlar
- TC NUM (Cluster B): Numerical modeling of cement-based materials
Chair: Prof. Klaas van Breugel
- TC SCM (Cluster B): Hydration and microstructure of concrete with supplementary cementitious materials
Chair: Prof. Nele De Belie



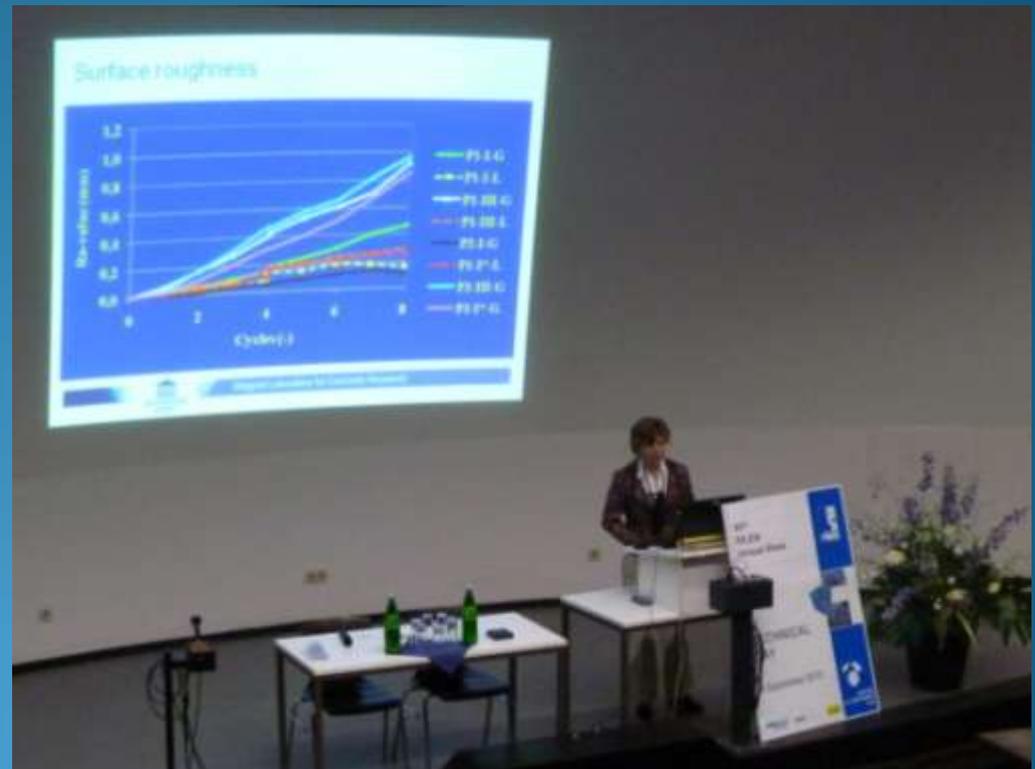
- 6 new TCs approved in 2011

- TC RTE (Cluster E): Reinforcement of timber elements in existing structures
Chair: Dr. Th. Tannert
- TDC (Cluster D): Test methods to determine durability of concrete under combined environmental actions and mechanical load
Chair: Prof. Y. Yao
- TDK (Cluster A): Testing methods for determination of double-K criterion for crack propagation in concrete
Chair: Prof. S. Xu



Dissemination of information

- Publications
- Meetings
- PhD-courses
- Books
- Website





Educational Activity Committee (EAC)

The Standing Committee EAC promotes RILEM educational activities worldwide. This may involve:

- Educational courses such as Doctoral courses, Short Seminars for the profession (e.g. practicing engineers) and Training Courses for university teachers;
- Educational publications such as Text Books and other teaching material.



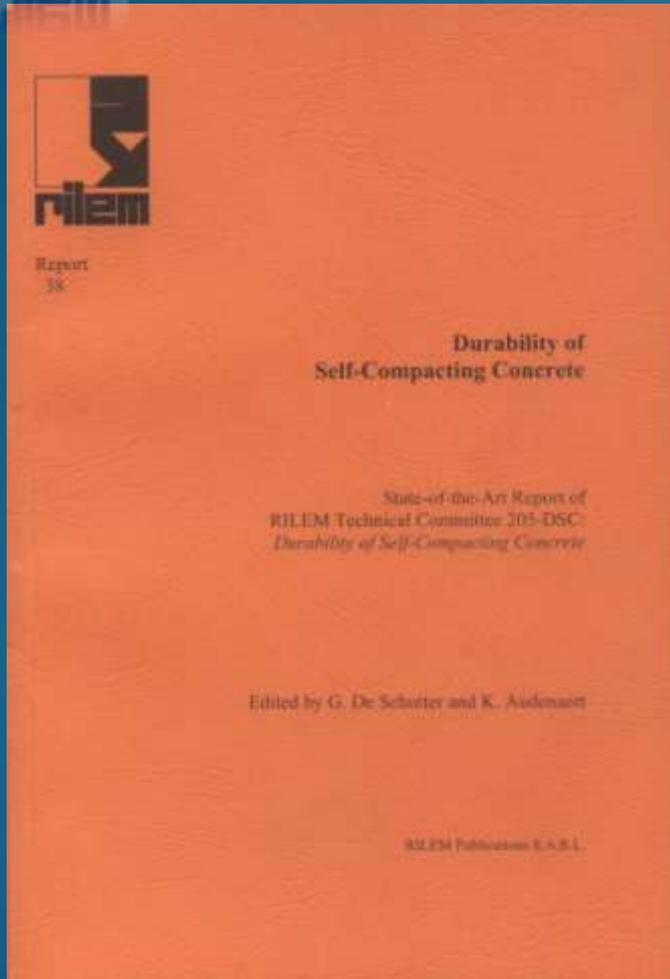
EAC Activities 2011

German-Russian Forum on concrete	31 Jan – 4 Feb	Dresden, D
CMC Concrete Microscopy Course	16-20 May	Delft, NL
Infrared and Raman Spectroscopy	1 July	Madrid, E
Cementitious material hydration	1 July	Madrid, E
Alkali activated binders	2 July	Madrid, E
Multi scale modelling	3 July	Madrid, E
NIST computer modelling workshop	20-22 July	Washington, USA
Cement and Concrete	25 Aug – 1 Sept	Nanjing, CN
Modelling localized inelastic deformation	12-16 Sep	Prague, CZ
Mechanics of Tire-Pavement Interaction	26-28 Sep	Delft, NL
Textile and Fibre reinforced concrete	6 Oct	Buenos Aires, AR
1º Simpósio Internacional IBRACON/RILEM	3 Nov	Florianopolis, BR

...



RILEM Publications



- Technical reports
- State-of-the-Art reports
- Proceedings of workshops and conferences
- Scientific Journal *Materials & Structures*



RILEM Awards

2007 N. Roussel
LCPC
Rheology of fresh concrete

2008 J. Weiss
Purdue University, USA
Volume stability of concrete

2009 P. Lura
Empa, Switzerland
Early age properties

2010 N. de Belie
Ghent University, Belgium
Biocatalytic processes and
self healing of concrete

2011 L. de Lorenzis
University of Salento, Italy
Interface modelling



- Robert L'Hermite Award



RILEM Awards



- Robert L'Hermite Award



- RILEM Fellow
- Honorary Member



RILEM Web server functions

- Services dedicated to RILEM members and activities
- Provide free access to most of RILEM publications and promote technical activities to enhance dissemination of knowledge and world-wide visibility

RILEM Website www.rilem.net



International union of laboratories
and experts in construction materials,
systems and structures

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[PUBLICATIONS](#)

[REGIONAL GROUPS](#)

Search

New Technical
Committees :
(created in 2011)

- [TC_MCD](#)
- [TC_NUM](#)
- [TC_SCM](#)

TC 223-MSC

Apply for the MSC Data-
Warehouse.

You can contribute to
enhance

the tool for data storage and
analysis on masonry
strengthening with
Composite materials

<https://rilem223dwh.isgweb.it/>



Welcome

Dear RILEM Members,

I am proud to present you the new RILEM website, more dynamic
and user-friendly.

Feel free to visit it and discover the latest improvements. The General
Secretariat will be glad to receive your comments and ideas.

Dr. Peter Richner
President of RILEM

News



Publication of the RILEM State- of-the-Art Report of TC 194-TDP

The RILEM State-of-the-Art Report of TC 194-
TDP: Applications of titanium dioxide photocatalysis
to construction materials is now published. ...

[read more](#)



Dr. Laura De Lorenzis, Robert L'Hermite Medallist 2011

During the RILEM Spring meetings, in Paris La
Défense, Dr. Laura De Lorenzis, University of

Events

29/05/2012 - 01/06/2012

INTERNATIONAL CONFERENCE ON NUMERICAL MODELING STRATEGIES FOR SUSTAINABLE CONCRETE STRUCTURES, SSCS'2012

Cement is responsible for 5 to 7% of the CO2
emissions in the world. It is the more used building ma...

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RILEM General Secretariat

sg@rilem.org

- Mrs. Pascale Ducornet, General Secretary
 - Mrs. Gilberte Combes
 - Mr. Grégory Censier
-
- The General Secretariat is available for the registrations, the publications and the technical activities.

LAT-Rilem

Goal Establish connections to Universities
Research Centers, Scientists and
Engineers in Latin America

Established Fall 2010 in Buenos Aires

Chairman Prof. Luis Lima

Rilem 40% discount for all
Membership fees: countries in Latin America



Summary of benefits and values

- Become part of a world-wide network
- Participate in active technical committees
- State of the art activities
- Interact with leading scientists and technologists

Visit us at

www.rilem.net



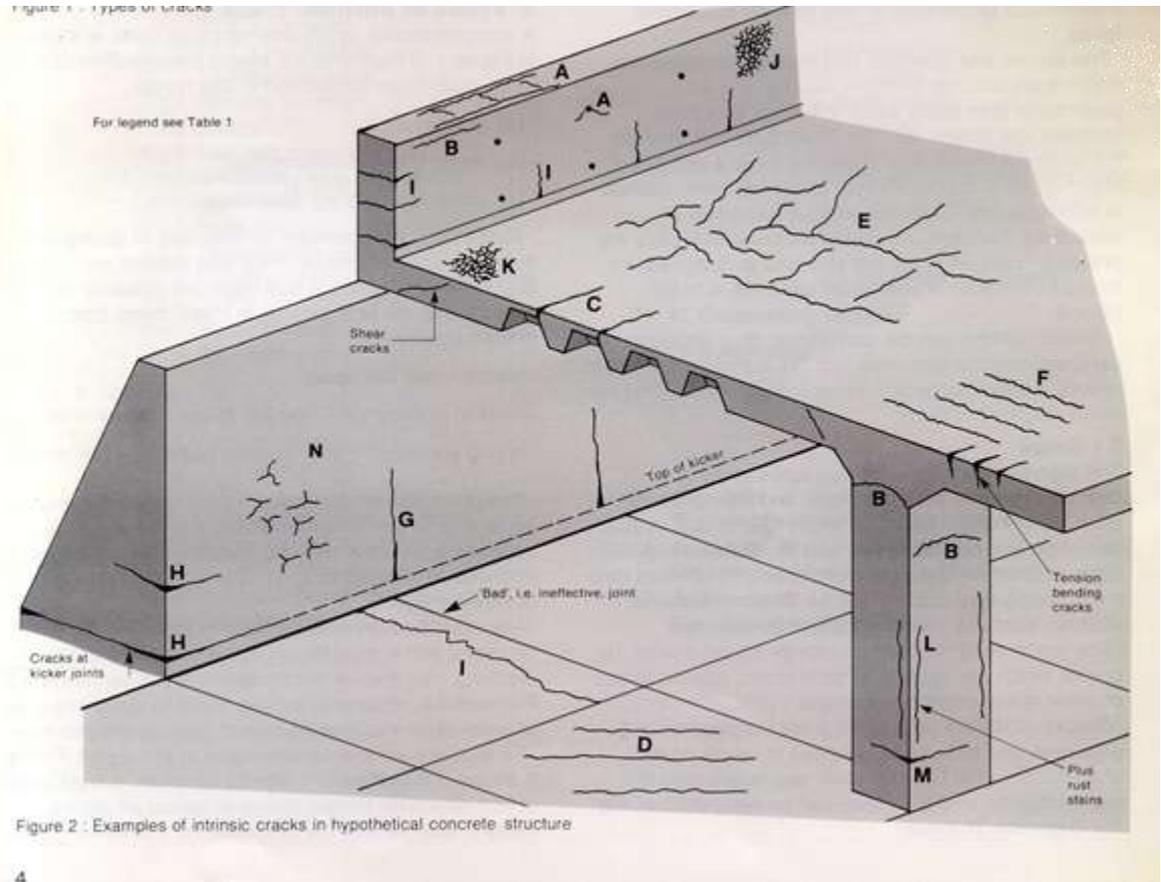


Topics and Results of TC's

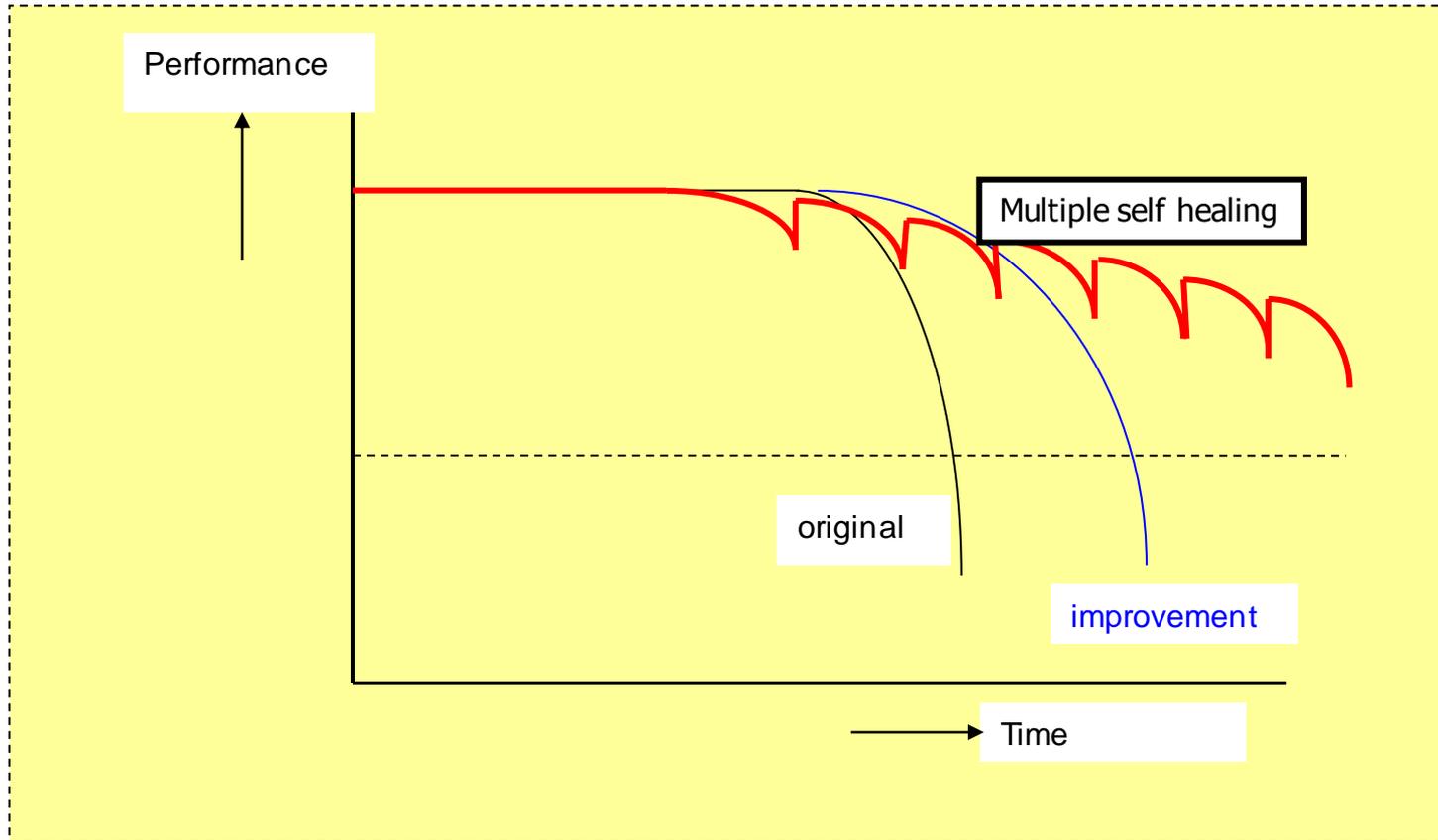
- **TC-221** Self healing phenomena in cement-based materials (TC Chair E. Schlangen)
- **TC-223** Masonry strengthening with composite materials (TC Chair M. R. Valluzzi)
- **TC-222** Simulations of concrete flow (TC Chair N. Roussel)

TC-221 Self healing phenomena in cement-based materials

Report by
Erik Schlangen



Self healing ambitions (multiple healing)



Is self healing always a solution?



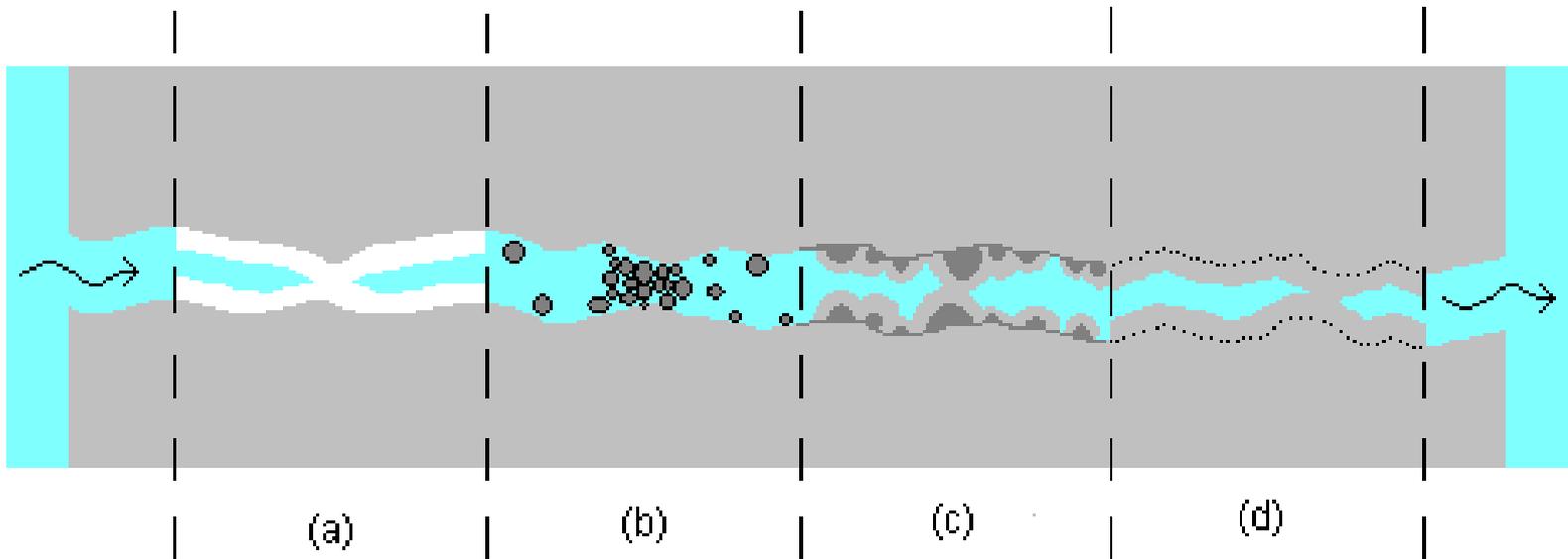
RILEM TC 221 Self Healing Concrete

- Dr. Oguzhan COPUROGLU
- Prof. Nele DE BELIE
- **Dr. Mario DE ROOIJ** (*Secr.*)
- Dr. Carola EDVARDESEN
- Prof. Mette GEIKER
- Prof. Dr Ningxu HAN
- Mr Chengwei HAO
- Prof. R. Doug HOOTON
- Mr. Haoliang HUANG
- Dr. Antony D. JEFFERSON
- Prof. Konstantin KOVLER
- Dr. Jianzhong LAI
- Prof. Robert LARK
- Prof. Victor C. LI
- Dr. Ahmed LOUKILI
- Prof. Dr.-Ing. Viktor MECHTCHERINE
- Prof. Hirozo MIHASHI
- Prof. Lars-olof NILSSON
- Mr. Tomoya NISHIWAKI
- Shunzhi QIAN
- Prof. Dr.-Ing. Hans W. REINHARDT
- **Dr Erik SCHLANGEN** (*Chair*)
- Mr. Yeqing SHEN
- Mr Luguang SONG
- Dr Pavel TRTIK
- Prof. Dr. Ir. Klaas VAN BREUGEL
- Mrs Kim VAN TITTELBOOM
- Prof. Jason WEISS
- Dr. Guang YE
- Mrs Xiongzhou YUAN



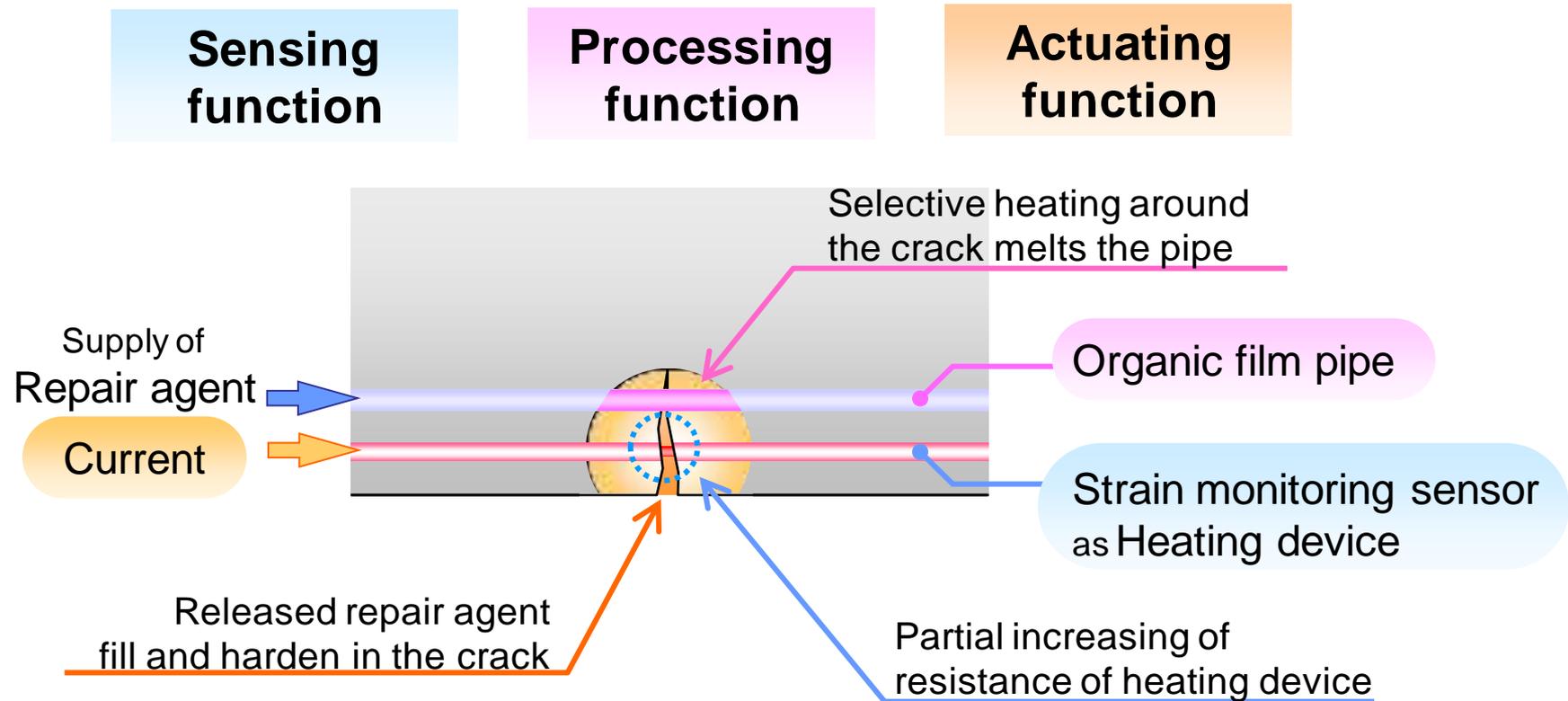
Some Possible Mechanisms for Self-Healing:

- a) Formation of CaCO_3 or Ca(OH)_2 in crack
- b) Loose parts blocking the crack path
- c) Ongoing hydration in the crack
- d) Swelling of cement matrix

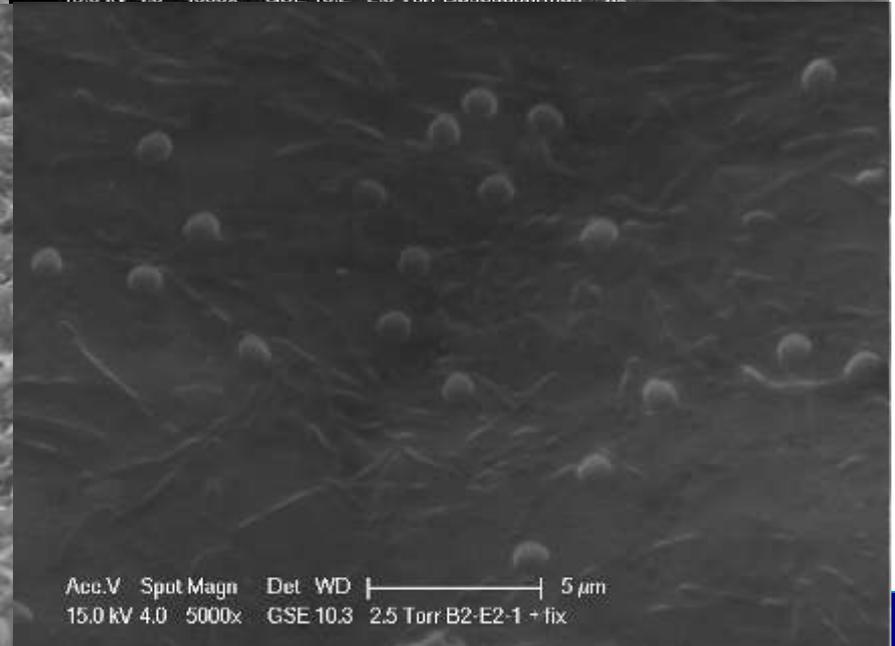
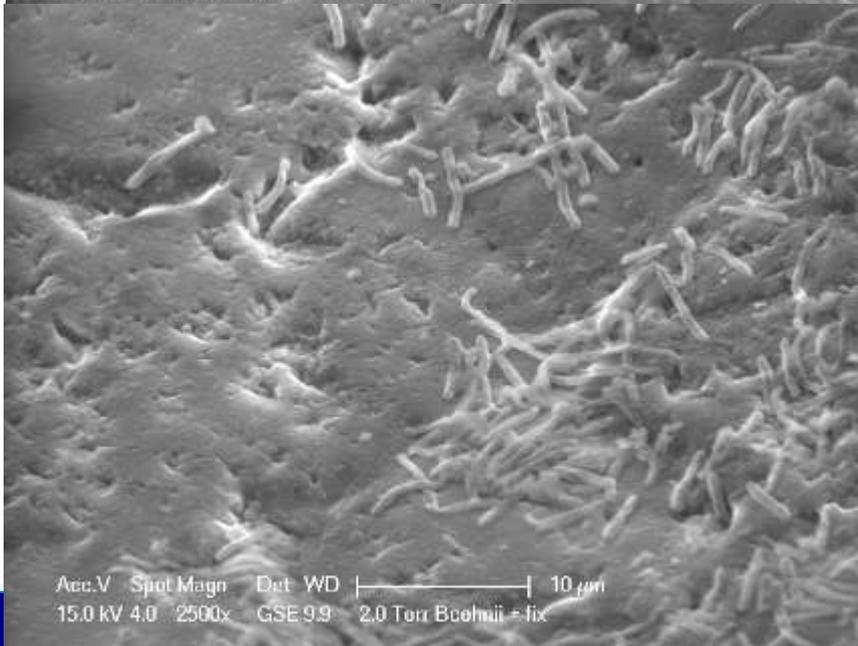
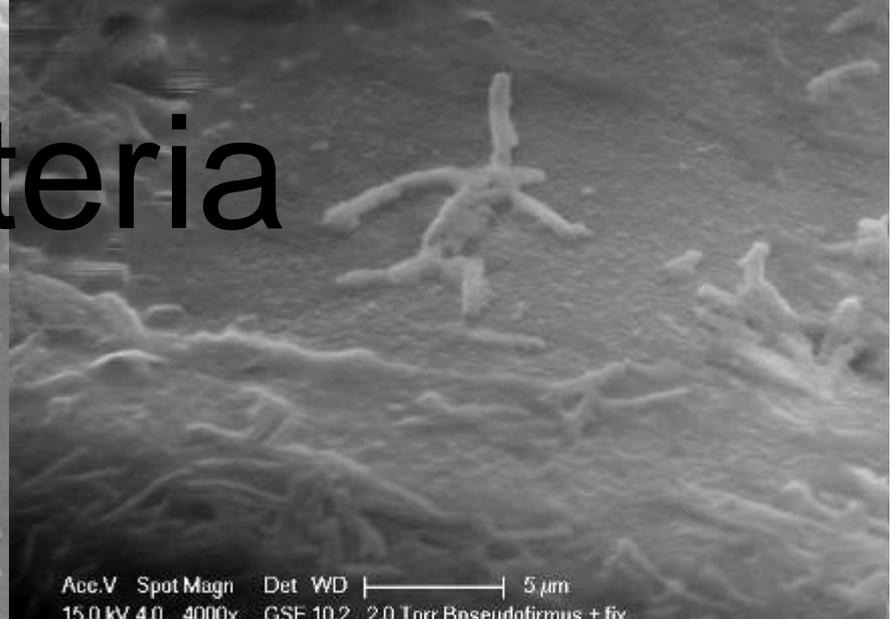
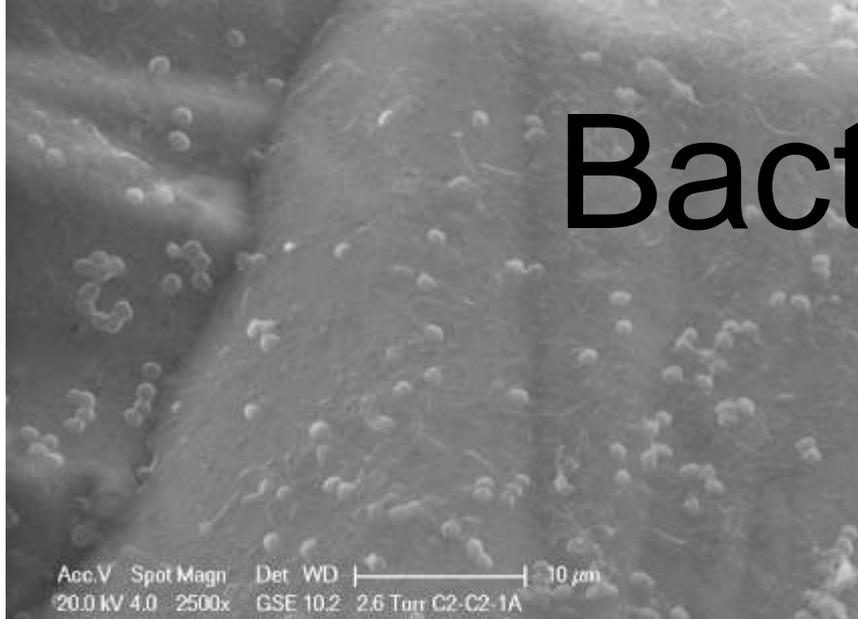


'Active' Self-Healing System

Self-healing using selective heating around generated crack



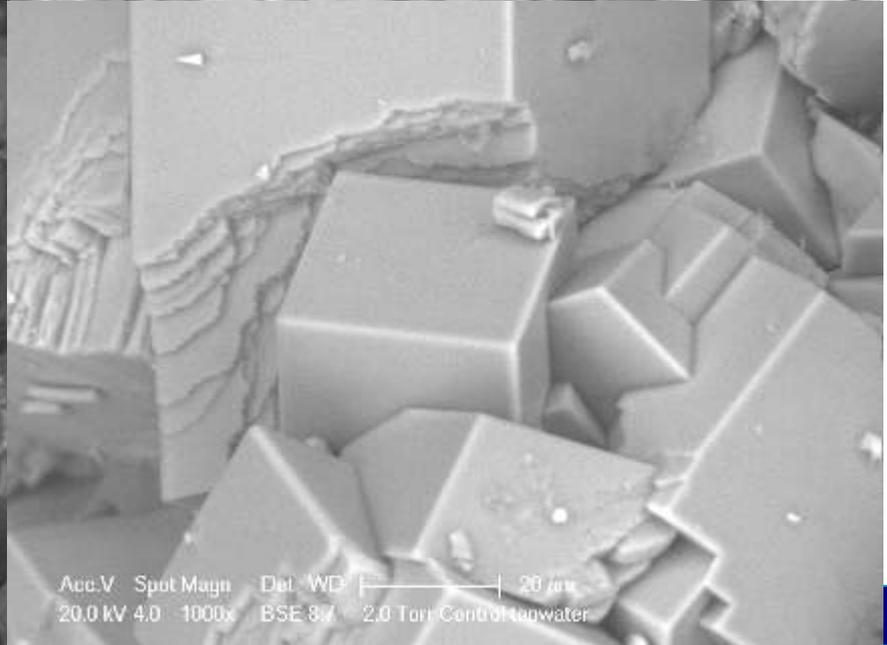
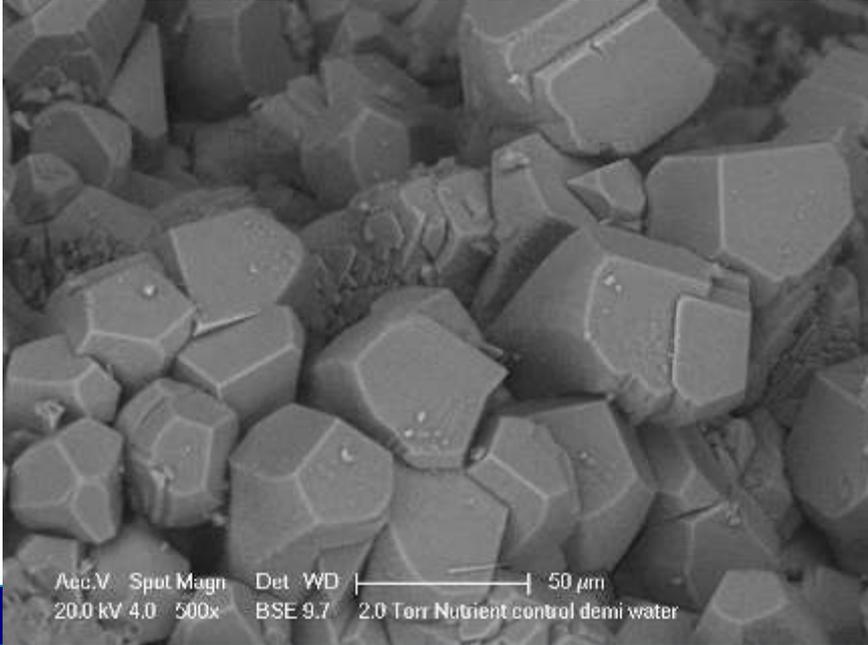
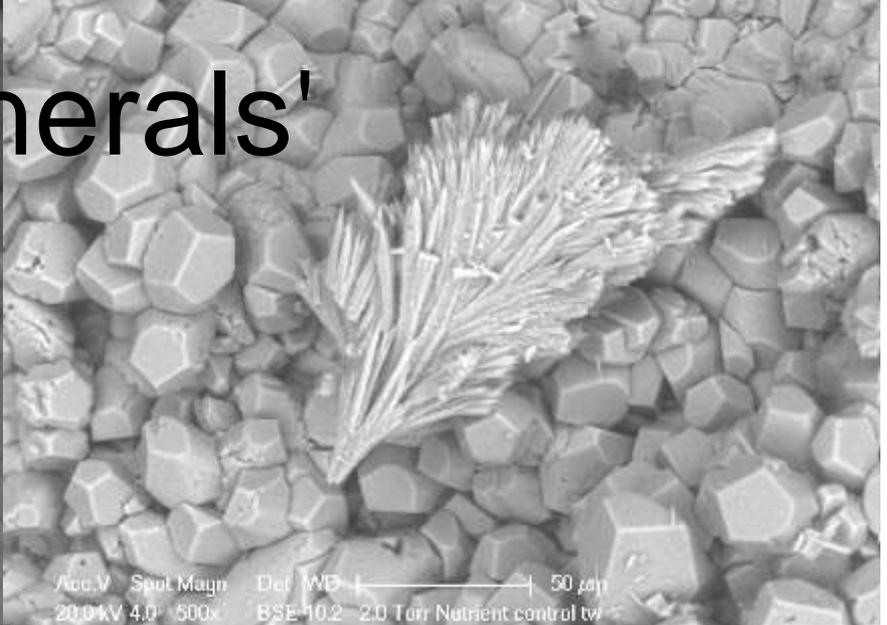
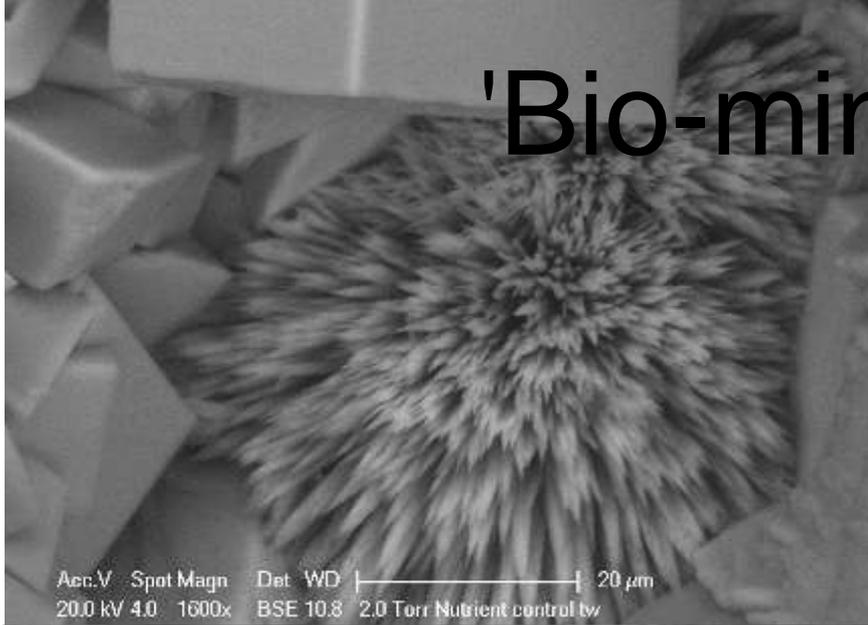
Bacteria



TC 221 Self healing

**Jonkers & Schlangen,
Netherlands**

'Bio-minerals'

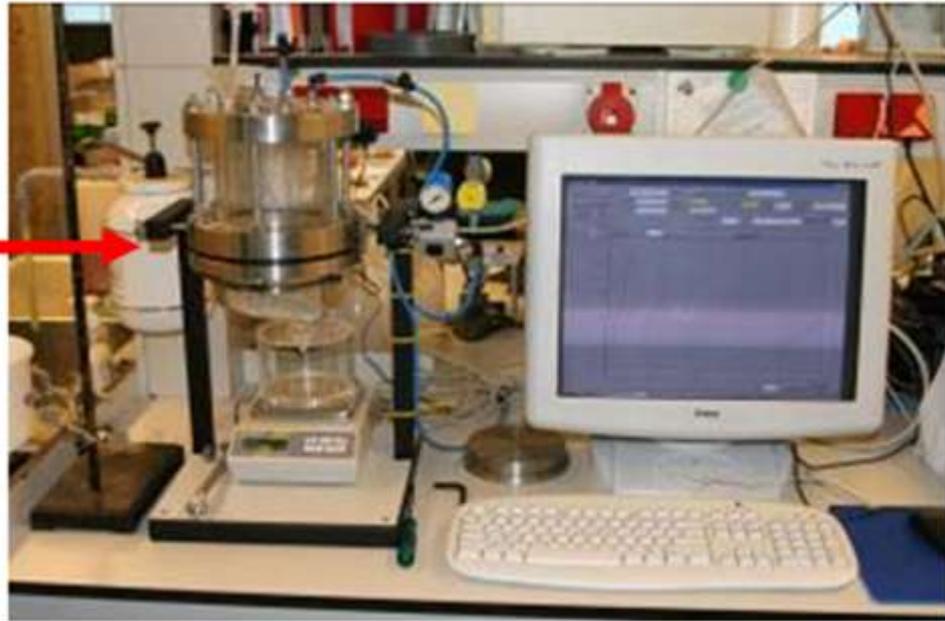
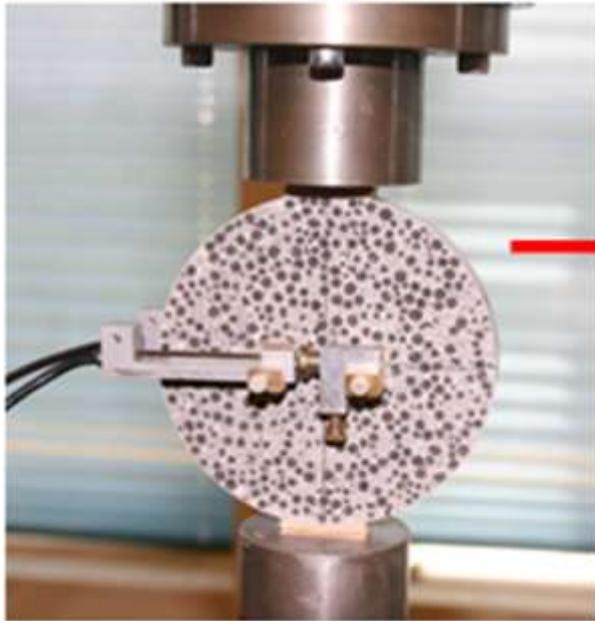
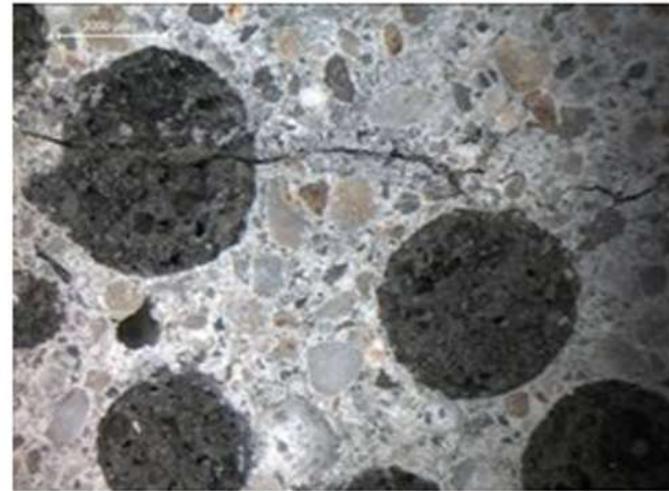


TC 221 Self healing

**Jonkers & Schlangen,
Netherlands**

Bacterial spores

Organics





Conclusions and future research

- Self Healing is not just a Hype!
- It really works!
- It needs input from different disciplines
- It can save a lot of money
 - Less repair work
 - Less material use
 - Less traffic jams
 - Good for the environment
- RILEM TC-221 gives insight!

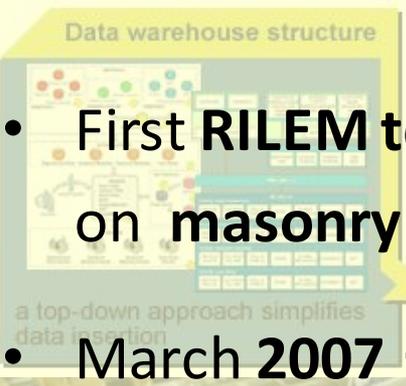




RILEM Technical Committee 223-MSC

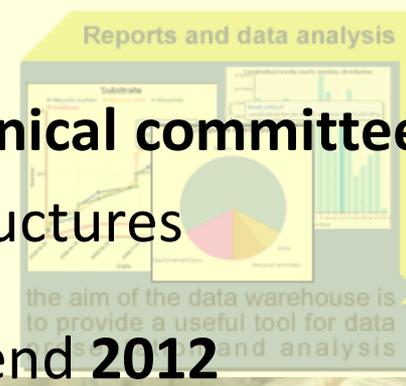
MASONRY STRENGTHENING WITH COMPOSITE MATERIALS

Chairperson: **Maria Rosa Valluzzi**, University of Padova, Padova, Italy
Secretary: **Daniel Oliveira**, University of Minho, Guimaraes, Portugal



Data warehouse structure

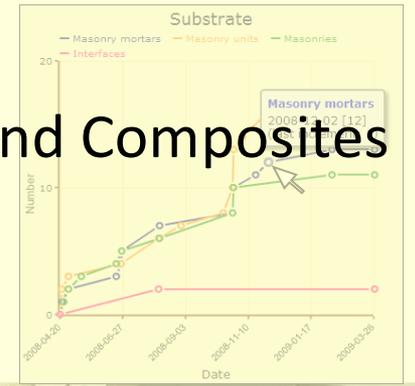
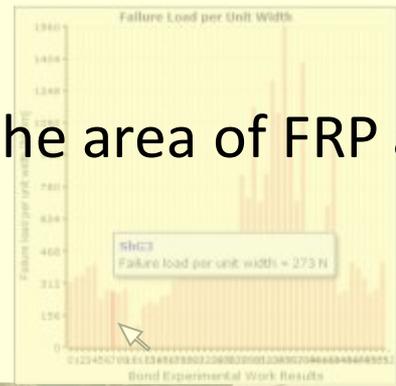
a top-down approach simplifies data insertion



Reports and data analysis

the aim of the data warehouse is to provide a useful tool for data presentation and analysis

- First **RILEM technical committee** in the area of FRP and Composites on **masonry structures**
- March **2007** → end **2012**



- **21** promoting members + **25** new affiliated members from **26** **Institutions** and **12** **countries**

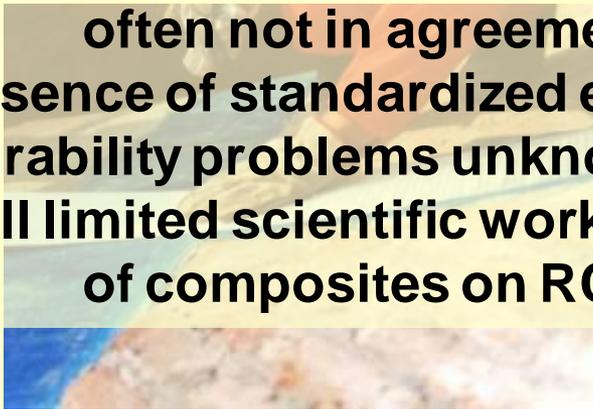


RILEM TC 223-MSC

Motivation

Large diffusion of applications even in historical field, in a contest of:

- lack of standardization: only CNR (IT) and ACI (US) available, often not in agreement and still in upgrading
- absence of standardized experimental procedures
- durability problems unknown
- still limited scientific works (in comparison with application of composites on RC)





RILEM TC 223-MSC

Objectives

Masonry **S**trengthening with **C**omposite materials

- **Systematization of current knowledge** on the structural behaviour of masonry strengthened with composites
- **Specification of limits and capability** of various systems in different contexts (modern, historical,..)
- **Identification of procedures for design and control** (limitation parameters of efficiency, simple test procedures, in-situ effectiveness)
- **Guidelines** for use of composite materials in existing masonry constructions



RILEM TC 223-MSC

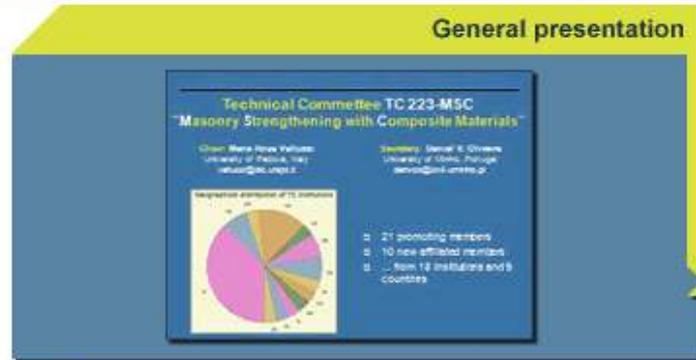
Products

Masonry Strengthening with Composite materials

- **Data WareHouse** (DWH) of the results obtained for various composite materials and types, masonry typologies, structural components and assemblages, local behaviour, case studies
<https://rilem223dwh.isqweb.it> (www.rilem.net)
- **State-of-the-Art Report** (STAR) on the current knowledge (experimental and analytical works, case studies, standards and codes, NDT and durability)
- **Round Robin Test** (RRT) on bond of EBR FRP textiles and SRP: double leap (DLST) and single leap shear tests (SLST), 12 laboratories, more than 280 tests
→ **Rilem Recommendations**
- **Durability tests** (crystallization problems, temperature and humidity influence on applications), 5 Labs → **Rilem Guidelines**
- **Workshop** in Wroclaw (SAHC 2012)



General presentation



Release 2.2.1



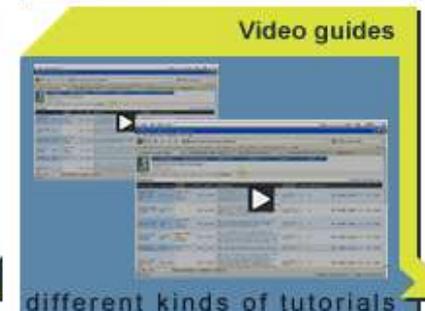
Registration

NOT A MEMBER?

APPLY FOR MEMBERSHIP

If you think you can contribute to RILEM TC 223-MSC Data warehouse as external contributor.

Video guides



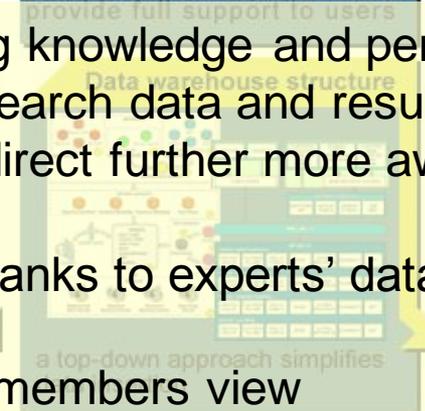
different kinds of tutorials provide full support to users

User Access

Login

I forgot my password

Data warehouse structure



a top-down approach simplifies

- The data-warehouse represents a modern tool for sharing knowledge and permits a quick real-time comparison and elaboration of research data and results.
- It is able to highlight needs and lacks in the field, and to direct further more aware research developments worldwide.
- It is completely free and it will be continuously updated thanks to experts' data contributions
- Only already published data are visible and available for members view



RILEM TC 223-MSC Data warehouse

MSC: MASONRY STRENGTHENING WITH COMPOSITE MATERIALS

Release 2.2.1

It is possible to organize data on:

- Materials: substrates and reinforcements
- Activity Layouts: test set-ups and other specific information
- References: authors, sources and publications
- Projects: connections among all parts
- Results: elaboration and comparison

by using:

- a user-friendly approach to simplify data insertion and records modification and view, sort and search the existing ones
- functions of duplication of records (useful for references, materials, ..) and live-search
- different kinds of tutorials (including video-guides)

The screenshot displays the 'MATERIALS' section of the RILEM TC 223-MSC Data warehouse. The interface includes a navigation menu with options like 'MATERIALS', 'ACTIVITY LAYOUTS', 'REFERENCES', 'PROJECTS', 'VIEW REPORTS', 'TOOLS', and 'HELP'. The main content area is divided into several sections:

- Masonry Units:** A table listing various masonry units with columns for 'Masonry unit label', 'Manufacturer name', 'Product name', 'Masonry unit type', 'Additional properties', and 'Links - Attachments'. Rows include 'UNEPD 6MPa Vuolu / Vault', 'UNEPD 5MPa Pavesi (square)', and 'UNEPD 18MPa reporting (R1)'. A search bar and 'Create New' button are present.
- Masonry Unit Attachments for UNEPD 18MPa reporting (R1):** A table showing attachments for a specific masonry unit, with columns for 'From', 'To', and 'Type'. Rows include 'From: NC_09', 'To: NC_09', and 'To: NC_09'.
- Projects:** A table listing projects with columns for 'Project label', 'Category', 'Activity Layouts', 'Year', 'Status', 'Publications', 'Contributor Institution', 'Links', and 'Attachments'. A row is shown for 'UNEPD BARREL VAULTS (Clay Bricks single skin)' with a status of '1998 - CLOSED' and a publication reference to 'ZSEI - Behaviour of brick masonry vault strengthened by FRP laminates, 2001 - Experimental analysis and modeling of masonry vaults strengthened by FRP, 1998 - Analisi sperimentale del comportamento di volte murarie rafforzate con FRP - (R1)'. A search bar and 'Search' button are present.
- Reinforcement Systems:** A table listing reinforcement systems with columns for 'Reinforcement system label', 'Adhesive', 'Mortar / Grout', and 'Textile'. A row is shown for 'articolo1 afrp' with an application of 'Externally bonded'. A search bar and 'Create New' button are present.
- Authors:** A form for creating a new author record with fields for 'Last name', 'First name (INITIALS (e.g. M.L.))', and 'Publications'. A search bar and 'Create' button are present.



This tool is able to generate data output as:

- ❑ reports (projects and materials) in Adobe® pdf format
- ❑ tables in MS Excel® format

and compare data and results by:

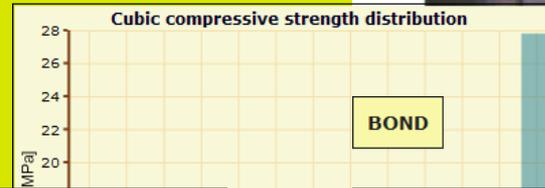
- ❑ charts and diagrams grouped as
 - General Charts
 - Data Charts
 - Results Charts

RILEM TC 223-MSC DATABASE 2.2.0 REPORT

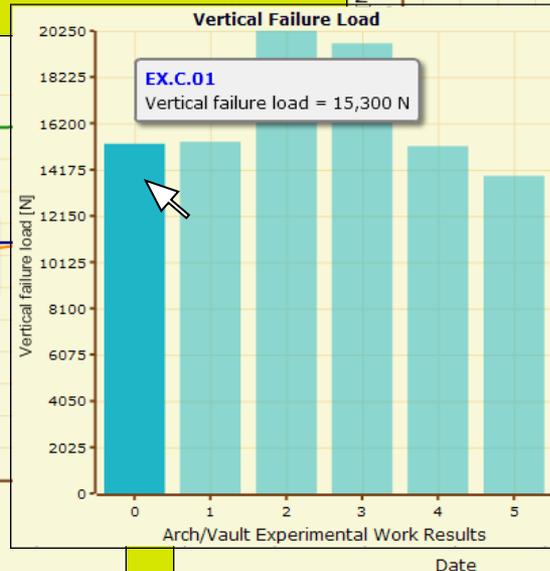
Project: UNIPD BARREL VAULTS (Clay Bricks single skin)



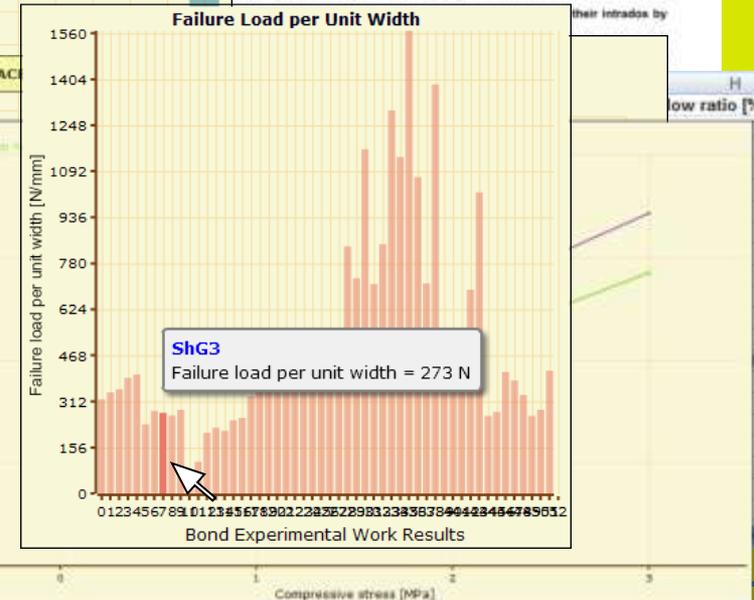
MASONRY MORTARS



ARCH/VAULT



BOND



INTERFACE

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201-17

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TC 222-SCF

Technical Committee Report :

SIMULATIONS OF CONCRETE FLOW

Chairman : Nicolas Roussel
Secretary : Annika Gram



*R. Schmitz, M. West
Fabric formed concrete*

ANALOGY WITH CONCRETE STRUCTURAL ENGINEERING

HARDENED CONCRETE

FRESH CONCRETE

MIX DESIGN

MIX DESIGN



**HARDENED STATE
MECHANICAL PROPERTIES**

**FRESH STATE
RHEOLOGICAL PROPERTIES**

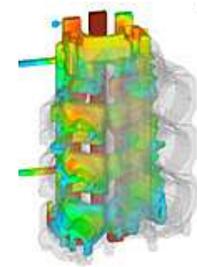
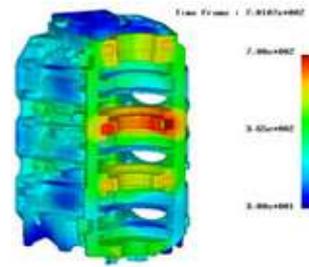
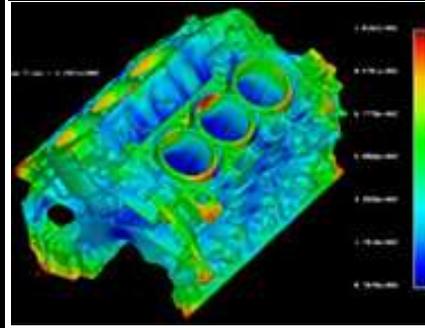
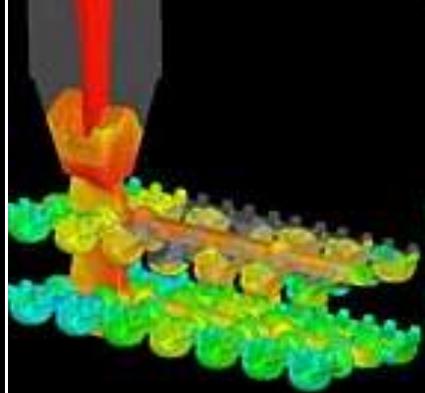
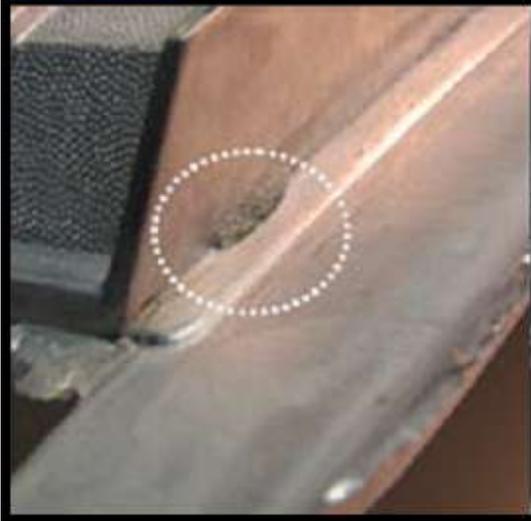
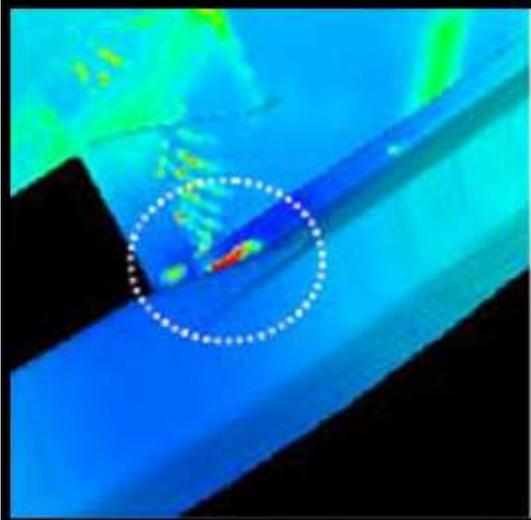


**PREDICTION TOOLS FOR
STRUCTURAL ENGINEERS**

**PREDICTION TOOLS FOR
PROCESS ENGINEERS**

WHAT ABOUT OTHER INDUSTRIES ?

Steel, aluminium and plastic industries

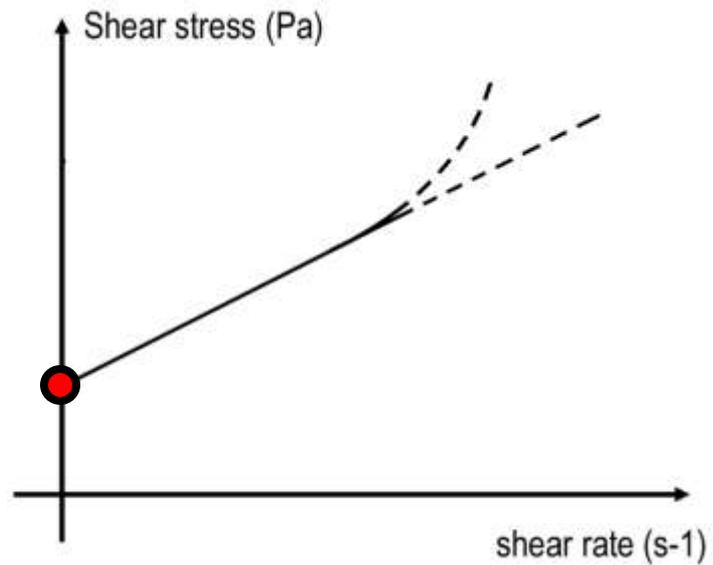
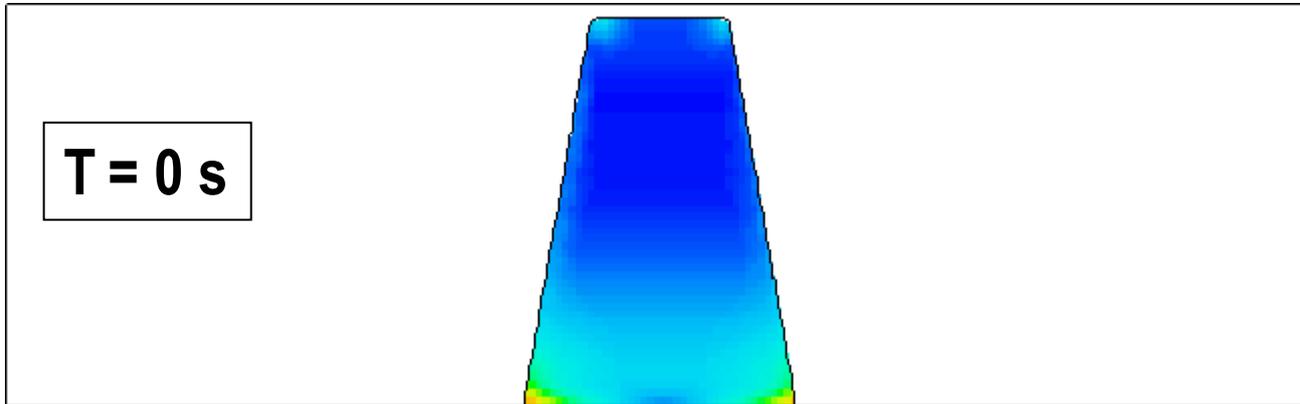


Industrial context



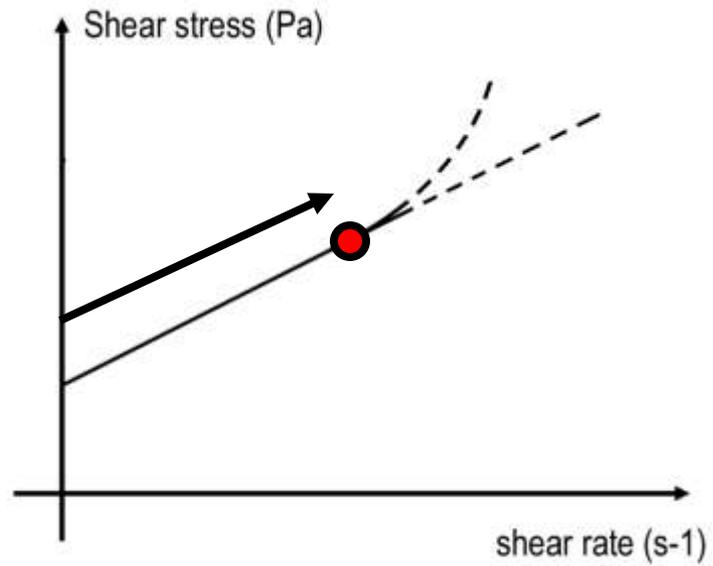
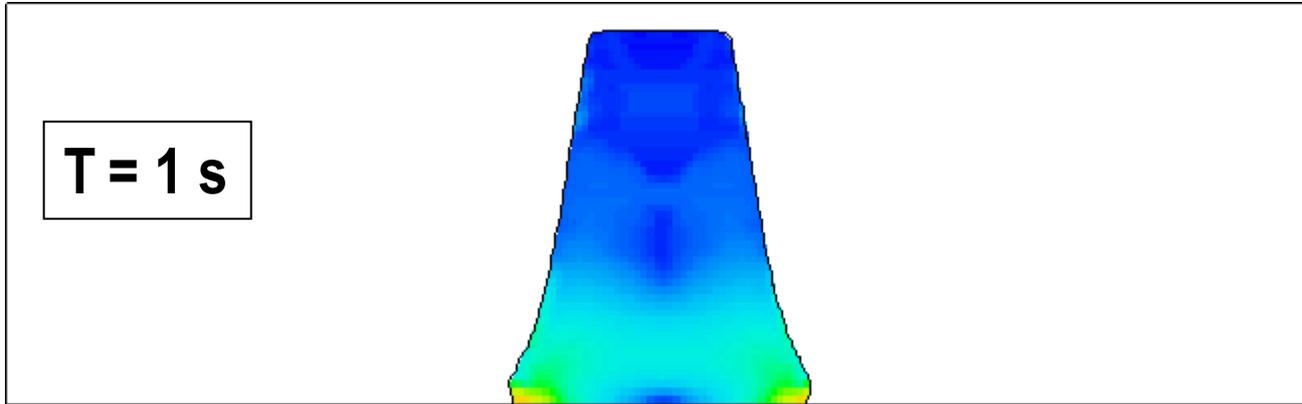
SLUMP AND SLUMP FLOW

Shear rate



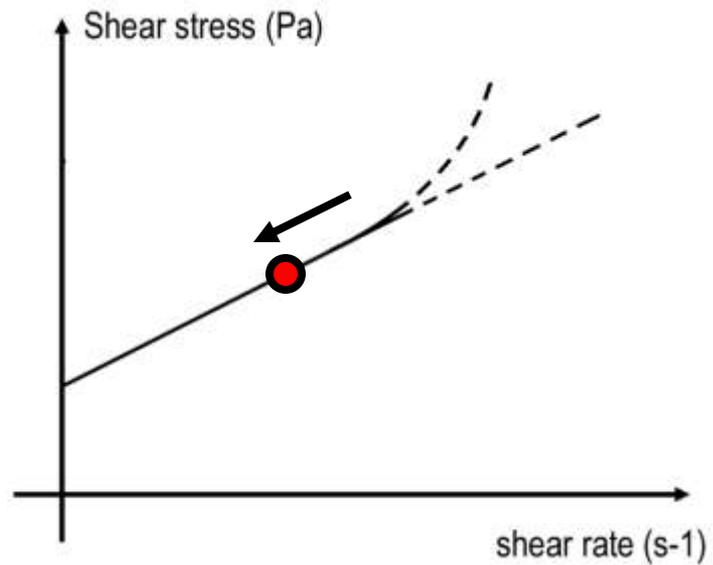
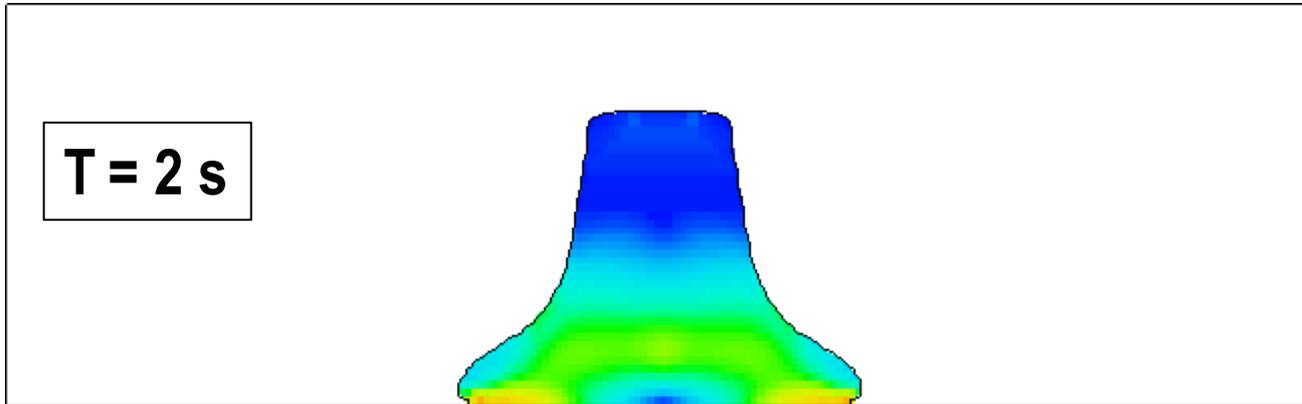
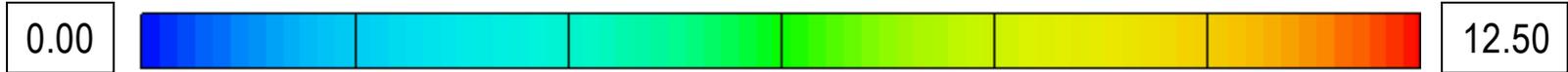
SLUMP AND SLUMP FLOW

Shear rate



SLUMP AND SLUMP FLOW

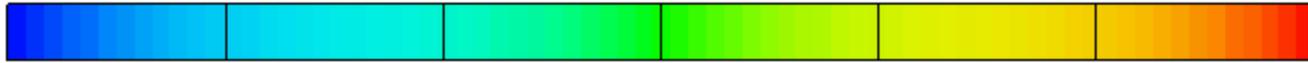
Shear rate



SLUMP AND SLUMP FLOW

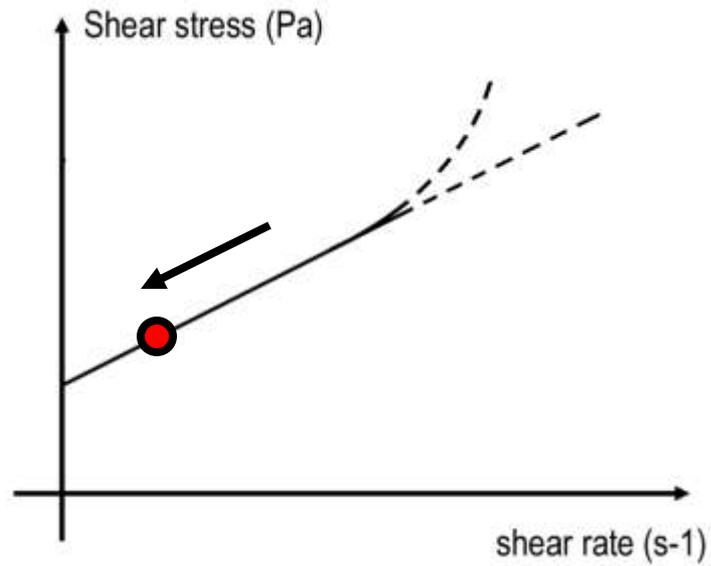
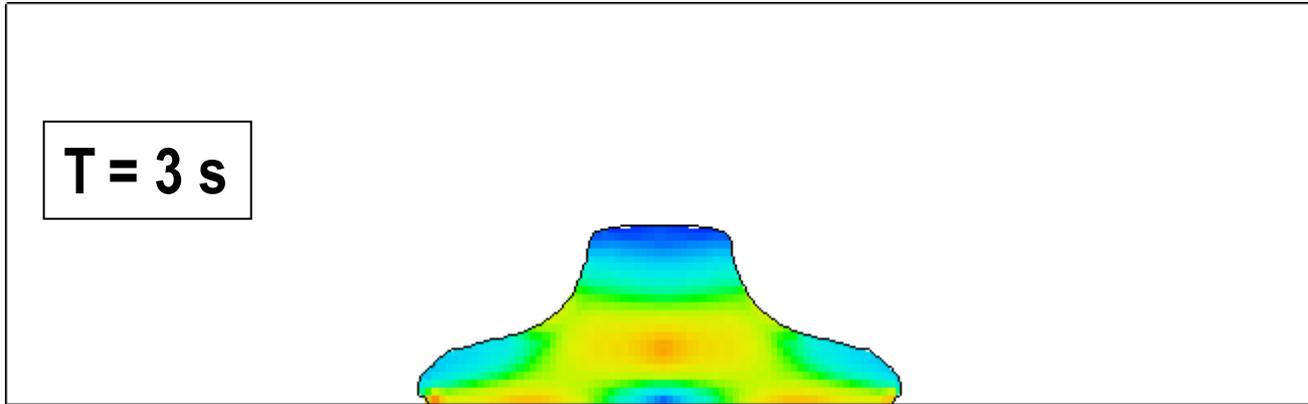
Shear rate

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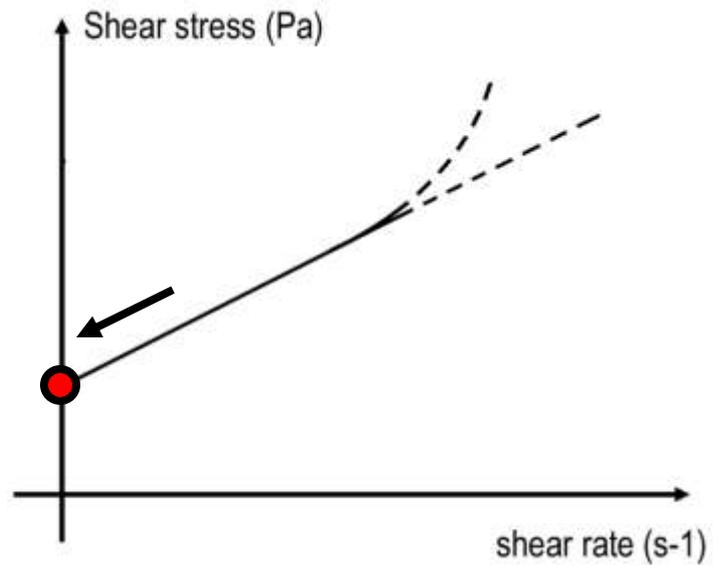
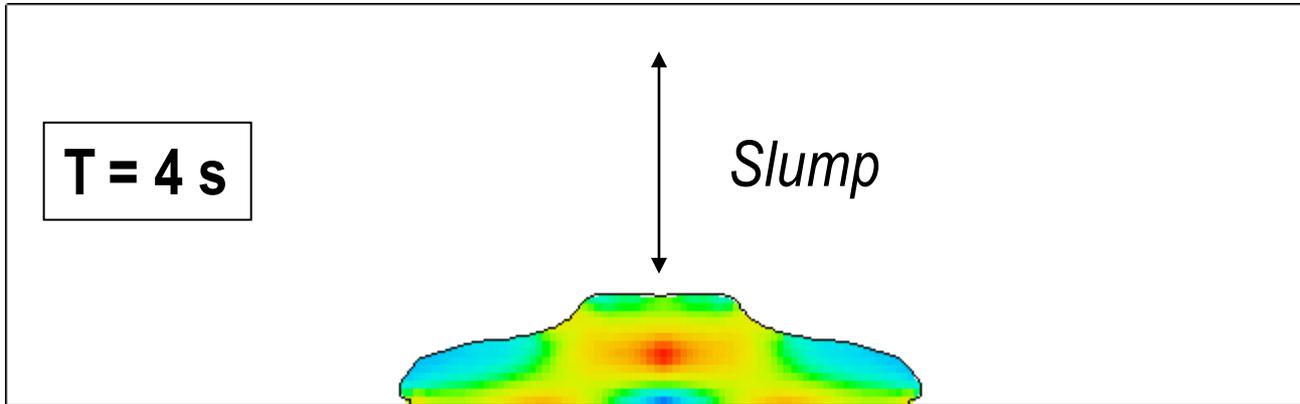
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T = 3 s

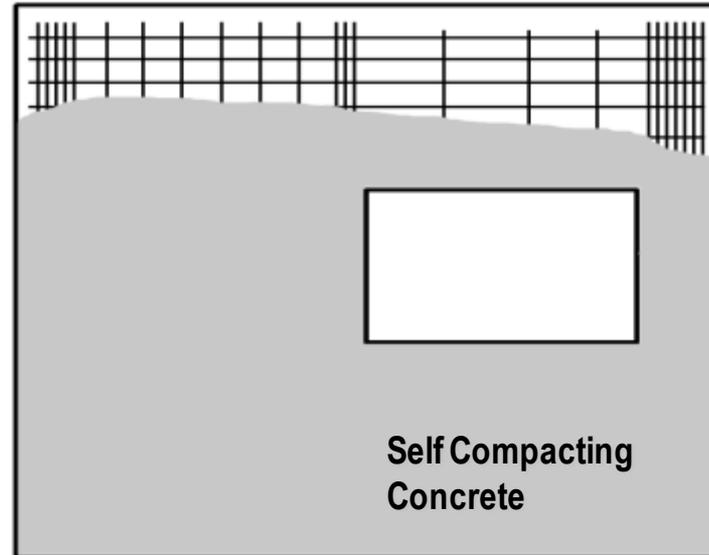
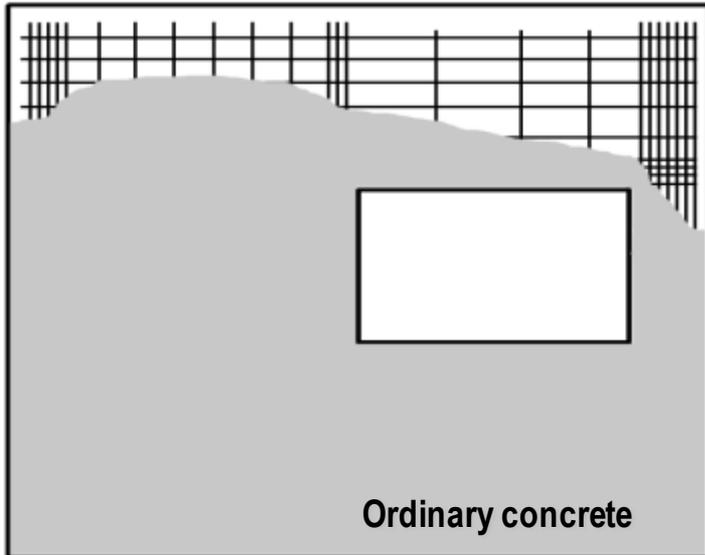
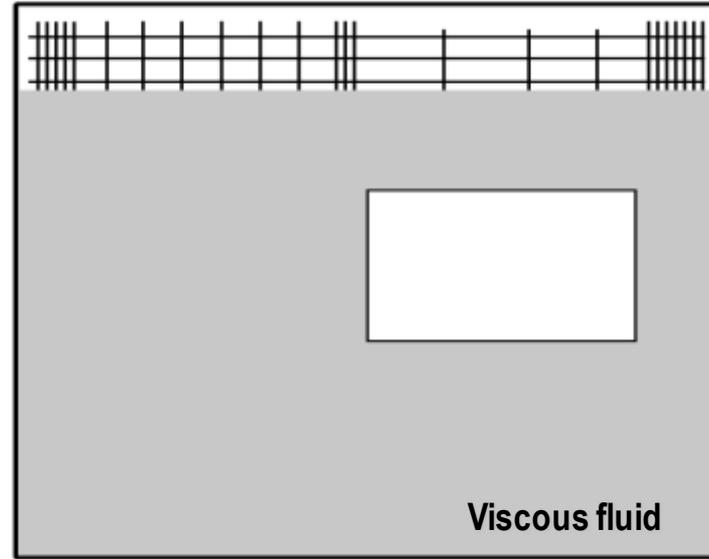
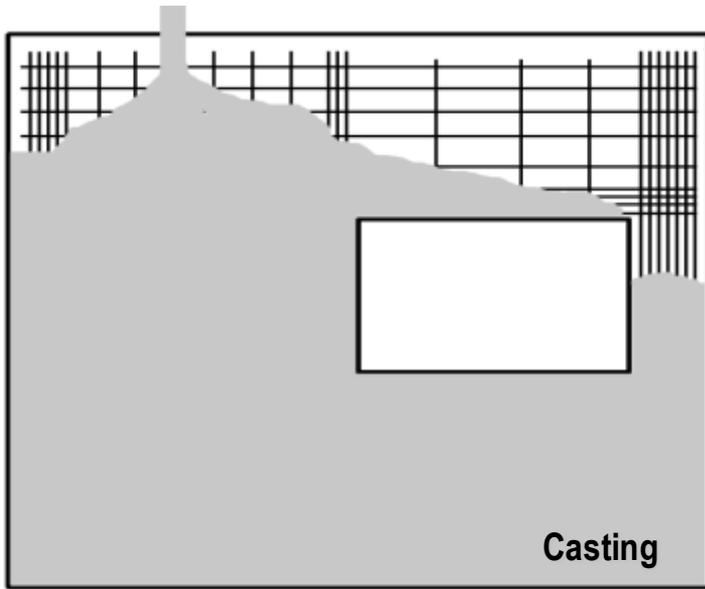


SLUMP AND SLUMP FLOW

Shear rate

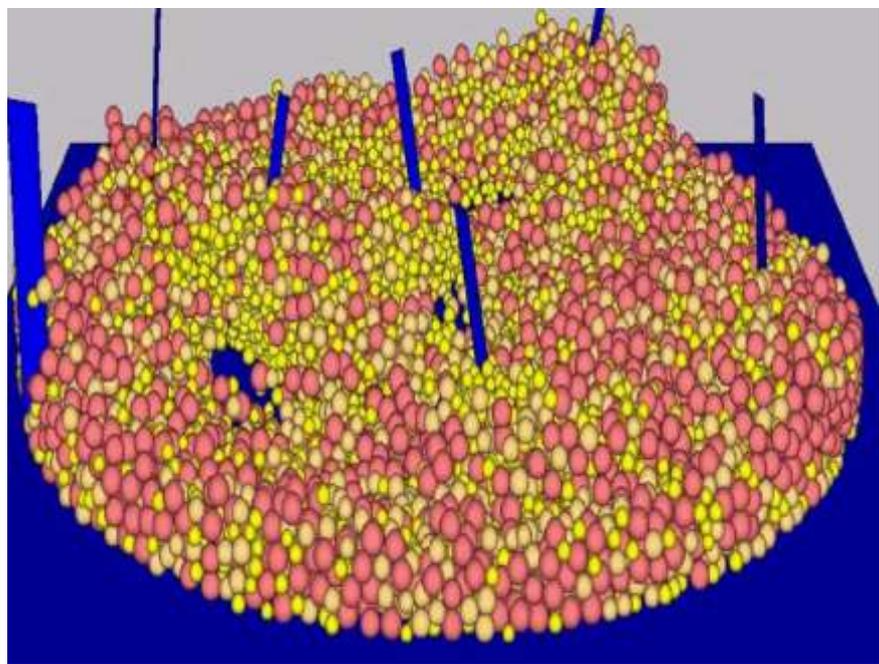
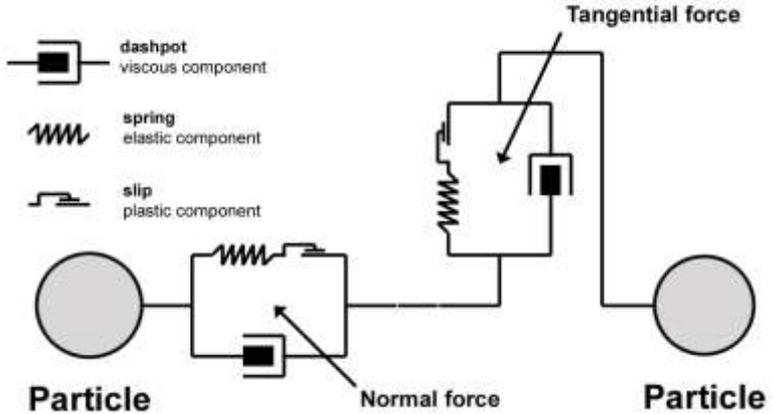
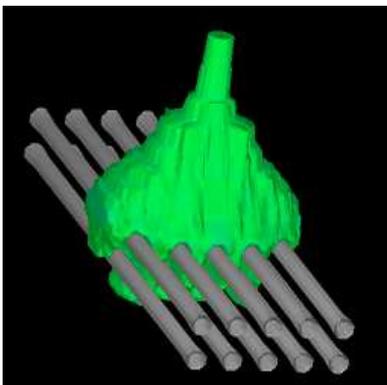
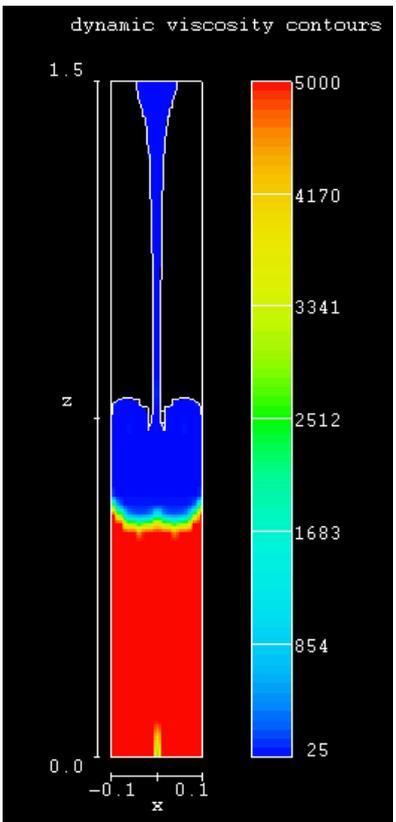


CASTING PROCESSES



NUMERICAL TECHNIQUES

Computational fluid mechanics

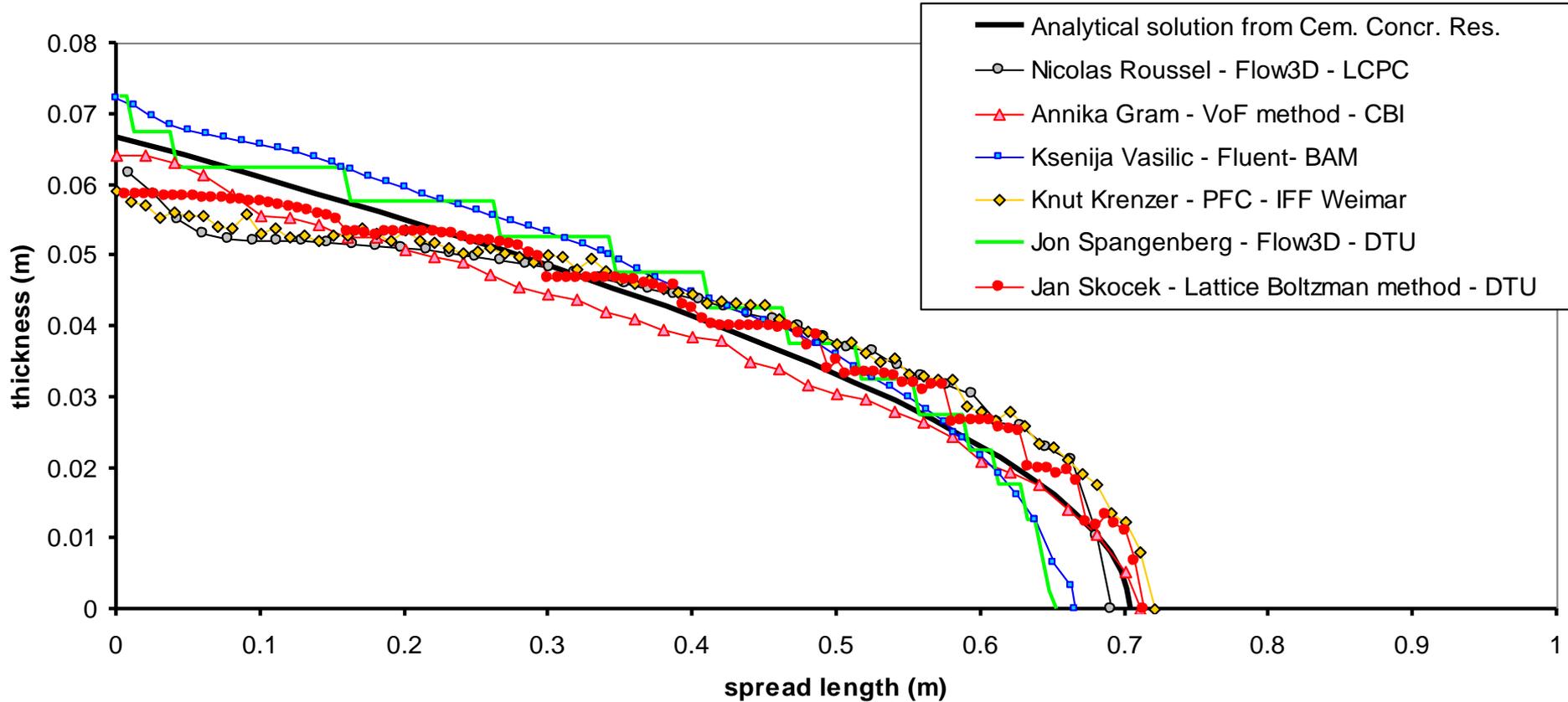


Distinct element methods



COMPARISON OF THE NUMERICAL TECHNIQUES

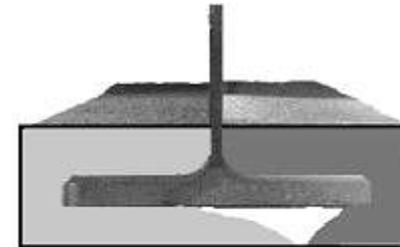
LCPC BOX



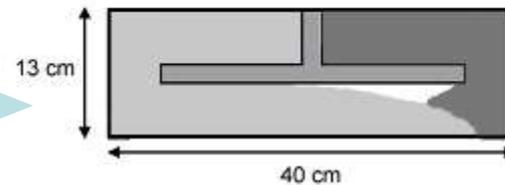
INDUSTRIAL APPLICATION

SCC with 120 Pa yield stress (SF 620mm)

Shape of the concrete in the formwork
(experimental)

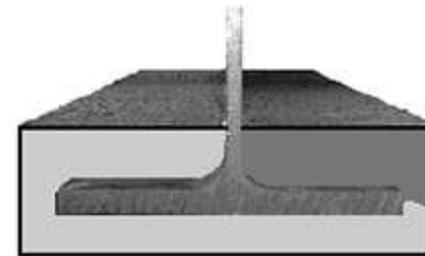


Shape of the concrete in the formwork
(simulation)



SCC with 60 Pa yield stress (SF 700mm)

Shape of the concrete in the formwork
(experimental)



Shape of the concrete in the formwork
(simulation)



Example 3 : machine and process development

