

CHALMERS Chalmers University of Technology

Research of Building Materials for Sustainable Building and Construction

Building Materials at Chalmers

We are a group for researching and teaching in building materials, with the **environmental perspective** and **holistic** approach to the adaptation of materials' life cycle, contributing to a sustainable society through basic research and innovative development of building materials

Research group Building Materials Prof Tang Luping

CHALMERS Chalmers University of Technology

Building Materials

– Play important role in sustainable built environment

Research group Building Materials Prof Tang Luping

CHALMERS Chalmers University of Technology

Serious social and economical consequences if failure

Research group Building Materials Prof Tang Luping

CHALMERS Chalmers University of Technology

Building Materials in Life Cycles

Environmental perspective

Research group Building Materials Prof Tang Luping

CHALMERS Chalmers University of Technology

Research focused on durability of porous materials

Research group Building Materials Prof Tang Luping

CHALMERS Chalmers University of Technology

Fundamental Knowledge

From microstructures to macro properties

From individual functions to interacting function

Research group Building Materials Prof Tang Luping

CHALMERS Chalmers University of Technology

Concrete in Chloride Environments

Chloride source 2
Deicing salt
 Cl^- Cl^- Cl^-
Corrosion!!! Corrosion!!!

Chloride source 1
Seawater
 Cl^- Cl^- Cl^-
Corrosion!!! Corrosion!!! Corrosion!!!

Research group Building Materials Prof Tang Luping

CHALMERS Chalmers University of Technology

Corrosion – One of the serious deteriorations of concrete exposed to marine environments

Research group Building Materials Prof Tang Luping

CHALMERS Chalmers University of Technology

Development of a Rapid Method for Testing Chloride Diffusivity

nordtest method
NT BUILD 492
Approved 1999-11

CONCRETE, MORTAR AND CEMENT-BASED REPAIR MATERIALS
CHLORIDE MIGRATION COEFFICIENT FROM NON-STEADY-STATE MIGRATION EXPERIMENTS

UDC:691.32(61):539(81):54

Research group Building Materials Prof Tang Luping

CHALMERS Chalmers University of Technology

Worldwide Applications of the RCM

nordtest method NT BUILD 492 Approved 1999-11

- 1st proposal (Tang & Nilsson, 1992)
- 1st complete method (Tang, 1996)
- EU DuraCrete recommendation (1998)
- Nordic standard NT BUILD 492 (1999)
- Swiss standard SIA 262/1 (2003)
- German BAW code (2004)
- American AASHTO TP 64 (2004)
- fib recommendation (Bulletin 34, 2006)
- Netherlandish translation (2008)
- Chinese standard GB/T 50082 (2009)

Chlorideindringwiderstand von Beton
(BAW-Merkblatt "Chlorideindringwiderstand")

fib bulletin 34
General Guidelines for Design and Reinforcement

GB
中华人民共和国国家标准
GB/T 50082 - 2009
普通混凝土长期性能和耐久性能
试验方法标准
Standard for test methods of long-term performance and durability of ordinary concrete

Research group Building Materials Prof Tang Luping

CHALMERS Chalmers University of Technology

Validation of models with infield data

Summarized in the book

RESISTANCE OF CONCRETE TO CHLORIDE INGRESS
TESTING AND MODELLING
TANG LUPING, LARS-DIETZ NILSSON AND AHMAD MUHAMMAD BASHEER

Research group Building Materials Prof Tang Luping

CHALMERS Chalmers University of Technology

Development of a Rapid Technique for Corrosion Mapping – RapiCor

CorrMeter SPTL-03
A Calibration-Free Technique with Error-Free Chloride Measurement and Automatic Corrosion Detection

Research group Building Materials Prof Tang Luping

CHALMERS Chalmers University of Technology

Applications of RapiCor



Instrument kit

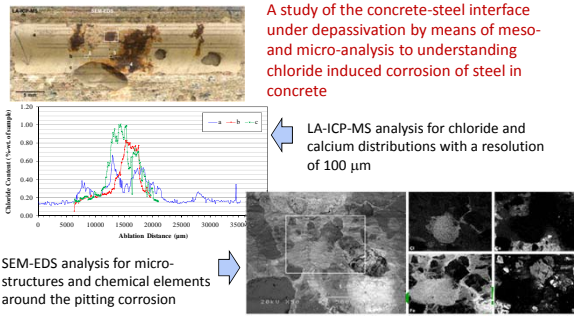
Various applications

Research group Building Materials Prof Tang Luping

CHALMERS Chalmers University of Technology

Critical Conditions for Depassivation of Steel in Concrete Exposed to Severe Environment

A study of the concrete-steel interface under depassivation by means of meso- and micro-analysis to understanding chloride induced corrosion of steel in concrete



LA-ICP-MS analysis for chloride and calcium distributions with a resolution of 100 μm

SEM-EDS analysis for micro-structures and chemical elements around the pitting corrosion

Research group Building Materials Prof Tang Luping

CHALMERS Chalmers University of Technology

Ageing of cementitious material for storage of nuclear waste

Financed by SKB 2010-2014

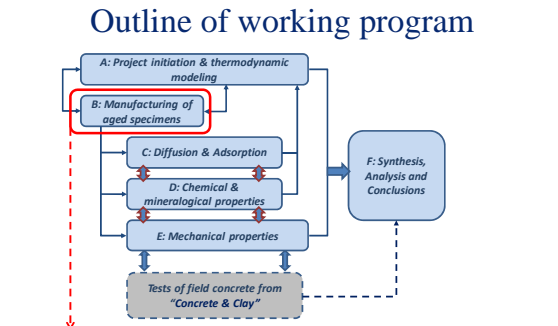
A durability question with perspective of 100 000 years

With an overall goal to establish a mechanism-based (chemo-mechanical coupled) model for safer prediction of longevity of concrete in storage facilities for nuclear waste

Research group Building Materials Prof Tang Luping

CHALMERS Chalmers University of Technology

Outline of working program




Development of an electrochemically accelerated method for ageing cement concrete specimens is in good progress


Research group Building Materials Prof Tang Luping

CHALMERS Chalmers University of Technology

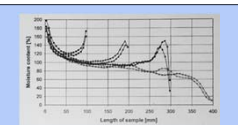
Other Durability Related Studies



Study of chemical emission from floor materials



Study of moisture condition in concrete



Ingemar Segerholm: Moisture transport processes in Scots pine

Åse Togerö: Leaching of Hazardous Substances from Concrete Constituents and Painted Wood Panels

Valter Dejke: Durability of FRP Reinforcement in Concrete

Research group Building Materials Prof Tang Luping

CHALMERS Chalmers University of Technology

Towards more offensive research

- *New type of durable concrete cover*
 - Low (less than 30-60%) cement content, corrosion prevention, cracking resistance
- *Lightweight concrete with hybrid functions*
 - Thermal insulation, fire resistance, water resistance, cracking resistance
- *Building materials for energy storage*
 - High thermal capacity, low voltage battery (small current but large volume)

Research group Building Materials Prof Tang Luping

CHALMERS Chalmers University of Technology

Covercrete with solar cells

An innovative way to make durable reinforced concrete structures with low cement content

With new cathodic prevention system

- Anode with e.g. carbon fibre or conductive polymer textile mesh
- Low driving current
- Solar cells for power supply

Making concrete with

- High w/c ratio
- Low cement content
- Small cover thickness
- Long service life (>100 yrs)

Save 30-60% cement!

Research group Building Materials Prof Tang Luping

CHALMERS Chalmers University of Technology

Novel concrete composites

Financed by FORMAS 2011-2015
(A sub-project in Homes for Tomorrow)

Combining modern engineered textile materials with nano-modified cement-based binder

With an overall goal to develop new composite materials for buildings, such as super-light porous concrete with high thermal insulation and reasonably good strength for wall insulation

Nano-size

Research group Building Materials Prof Tang Luping

CHALMERS Chalmers University of Technology

Durable Building Materials

Research group Building Materials Prof Tang Luping

CHALMERS Chalmers University of Technology

Concrete Composite for H/T

- Tailored, hybrid for building thin, light and replaceable houses

Research group Building Materials Prof Tang Luping