

MAGICON

MAterials Genome engineering for re-Inventing CONcrete



Workshop

CONCRETE FOR EXTREME ENVIRONMENTS

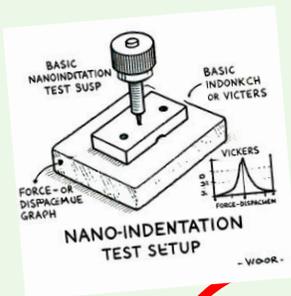
23/10/2025, 15:30 - 18:30

Luleå University of Technology
and online

Erik Schlungen

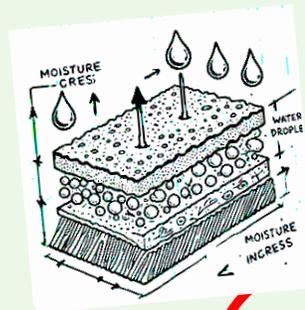
2025

INTERVIEW
RECRUITING
KICK OFF



2027

MECHANICAL TESTING
EIGEN STRESSES
CREEP



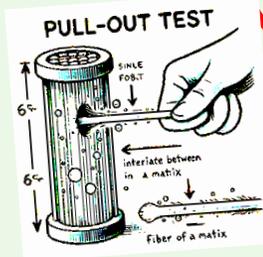
2029

NUMERICAL SIMULATIONS
AI MODELLING



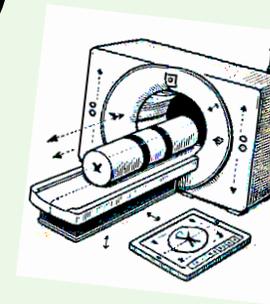
2026

DESIGN OF EXPERIMENTS
SELF-HEALING STRATEGIES



2028

MOISTURE TRANSPORT TESTING
DURABILITY

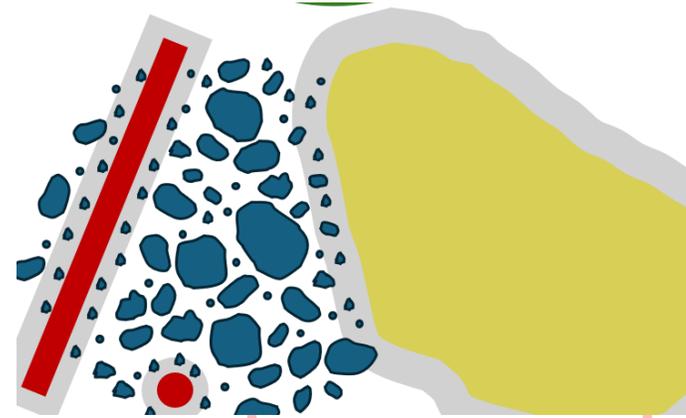


2030

PHD GRADUATIONS
WORKSHOP
CLOSURE

MAGICON

2025



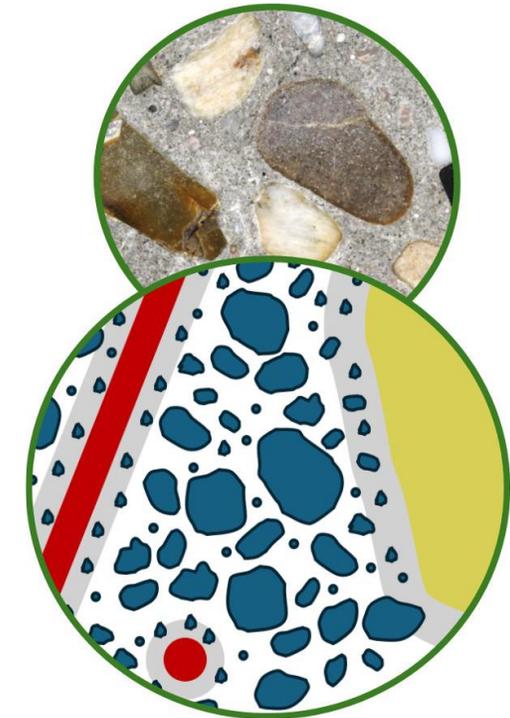
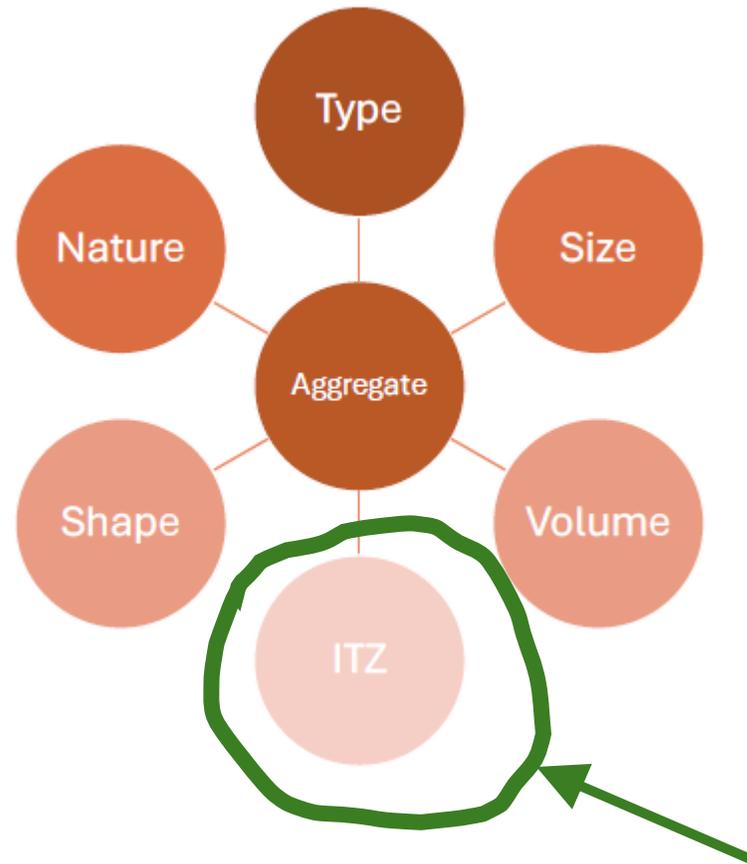
- **MAterials Genome engineering for re-Inventing CONcrete**
- **March 18th: Interview ERC-Panel-PE8**
- **June 15th: MAGICON is Granted**
- **Launching MAGICON-website www.erc-magicon.eu**
- **Contacting peers/competitors**
- **Selecting PhD's and Postdocs**



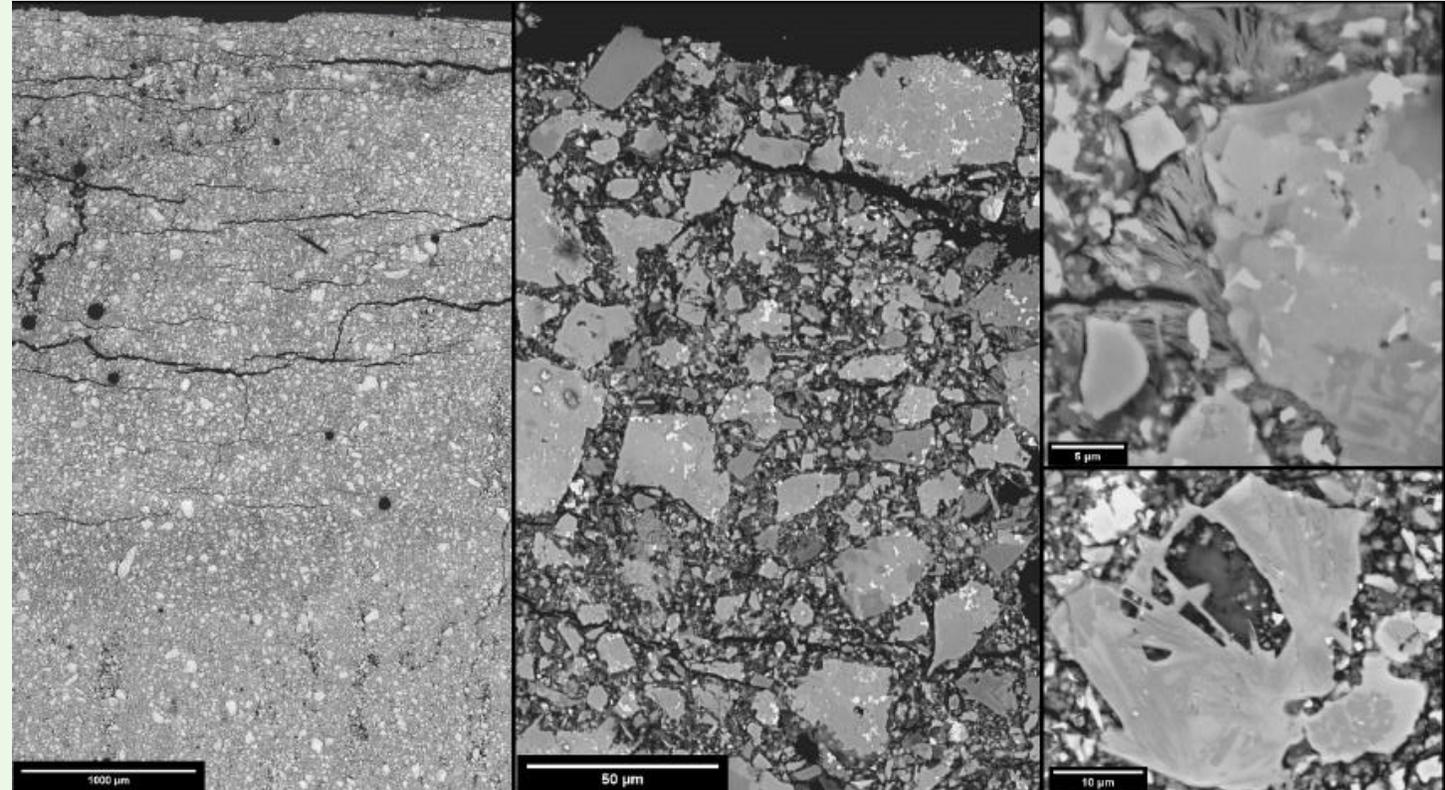
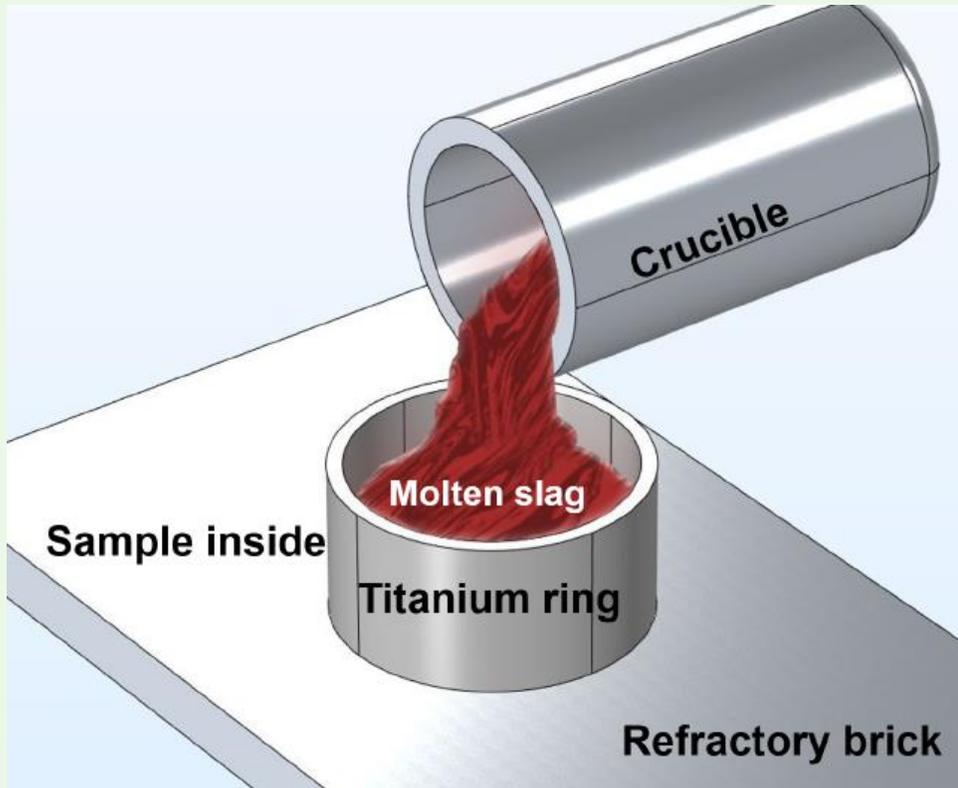
MAGICON



marcin.sundin@ltu.se



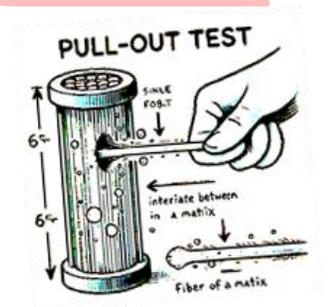
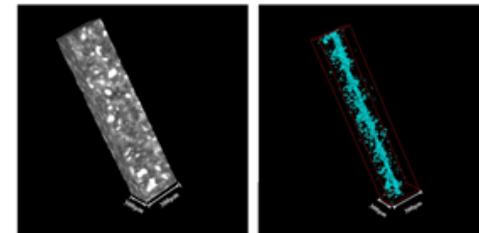
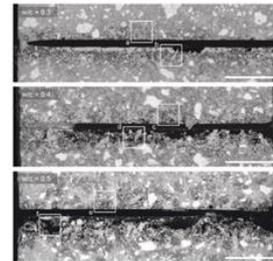
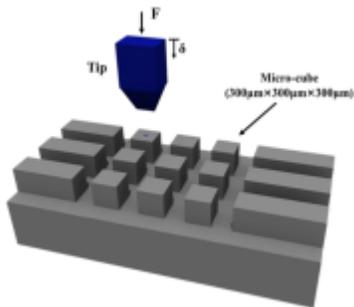
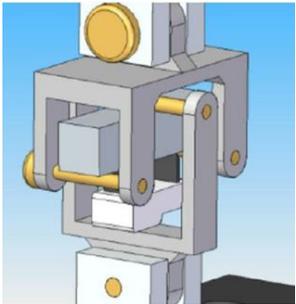
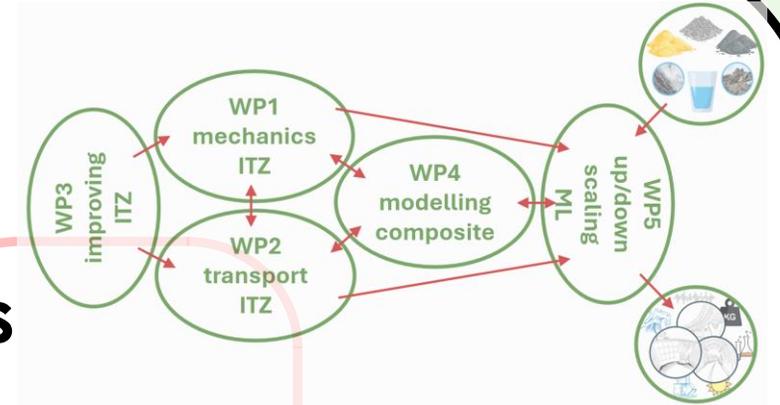
Recent “Fire Research” at Delft



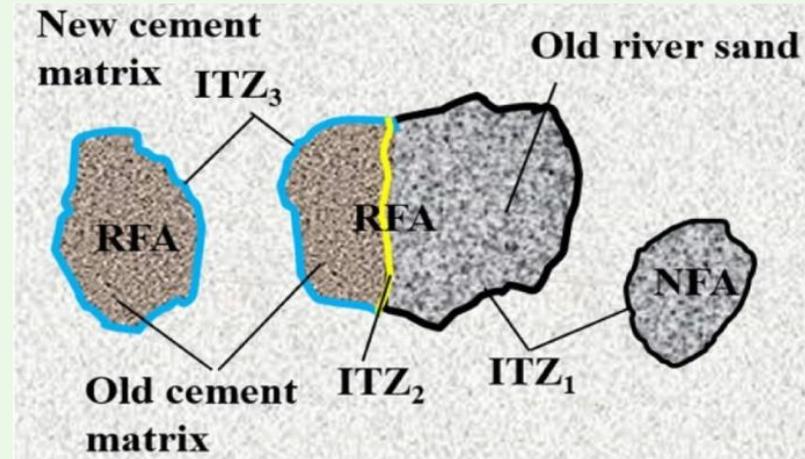
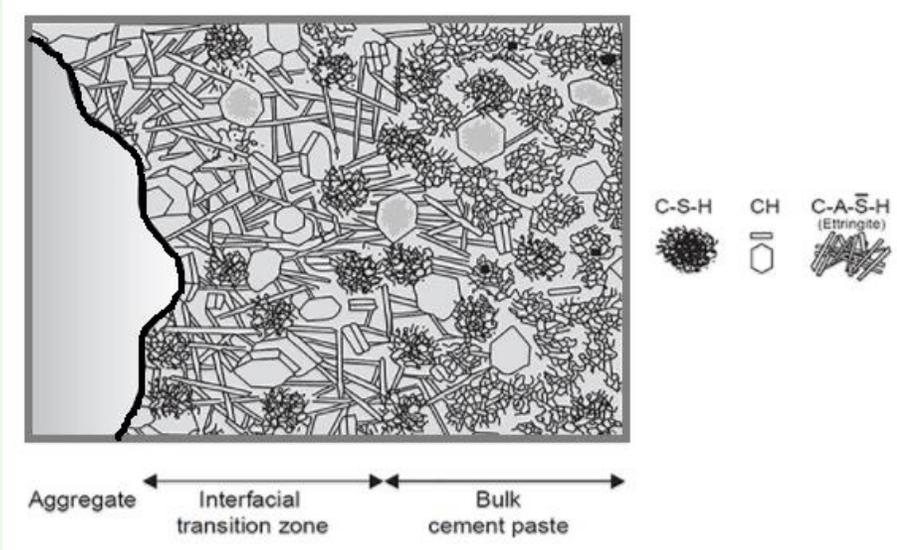
Fernando FRANÇA DE MENDONÇA FILHO
THERMAL SHOCK DAMAGE IN CONSTRUCTION MATERIALS
PhD-thesis Delft University, 2023

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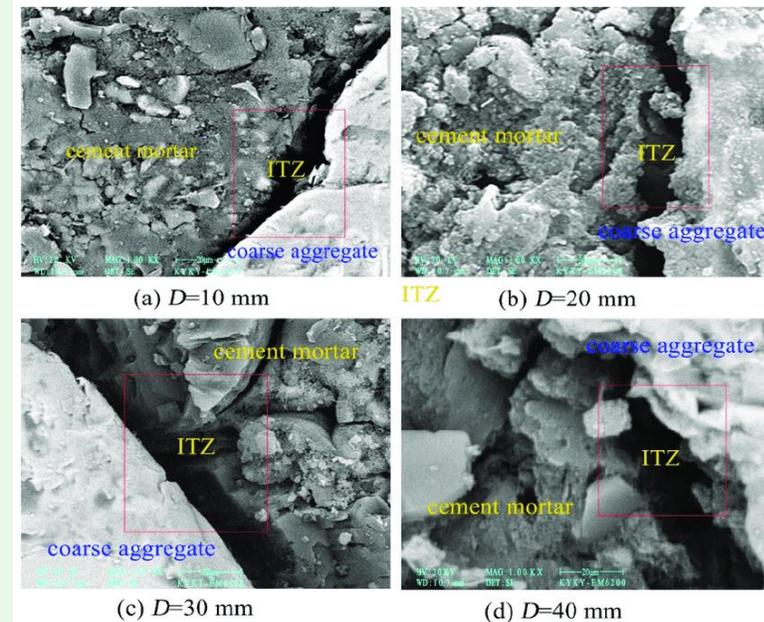
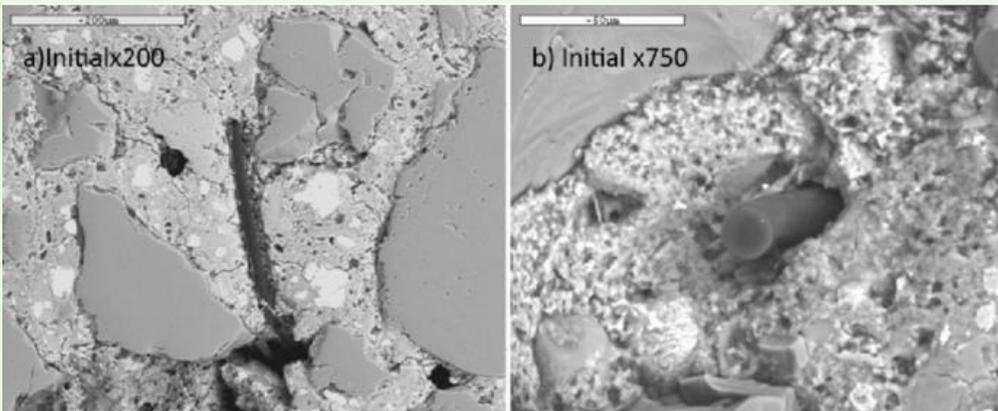
- **GOAL** (       )
- **Design of experiments**
- **Challenge: Design self-healing strategies**
- **Challenge: Make samples with eigen-stresses**
- **Design and**  **building climate chambers**



Select materials



<https://doi.org/10.1515/rams-2021-0021>

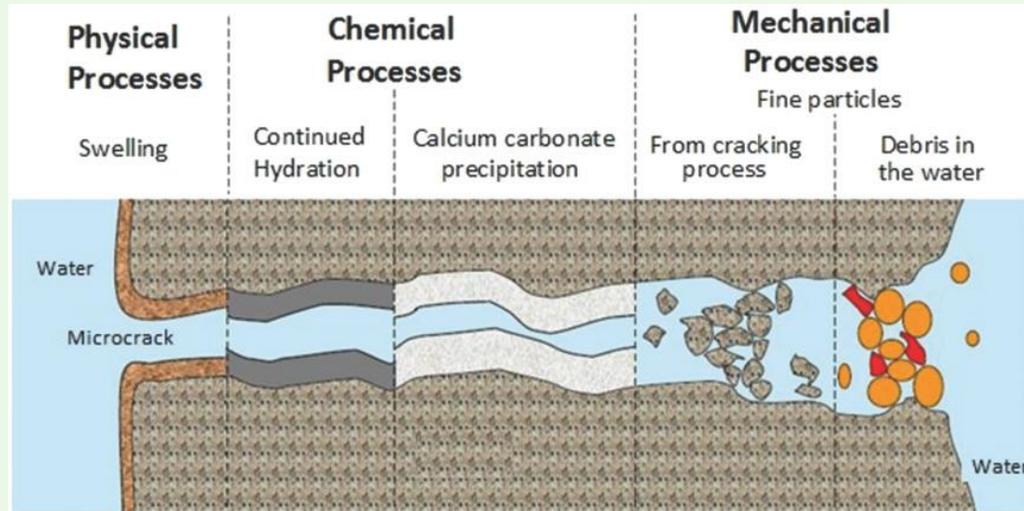


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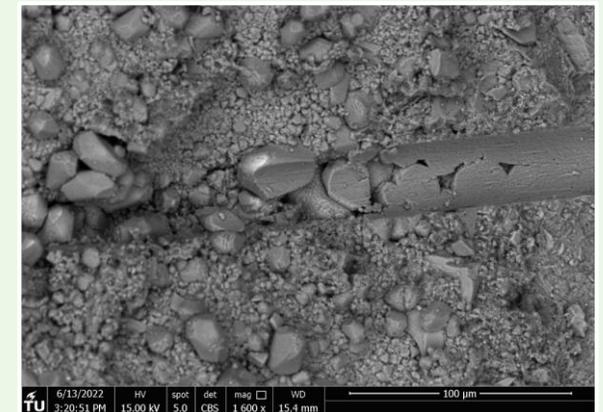
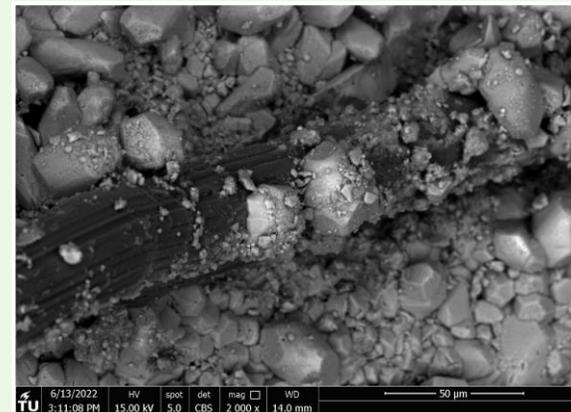
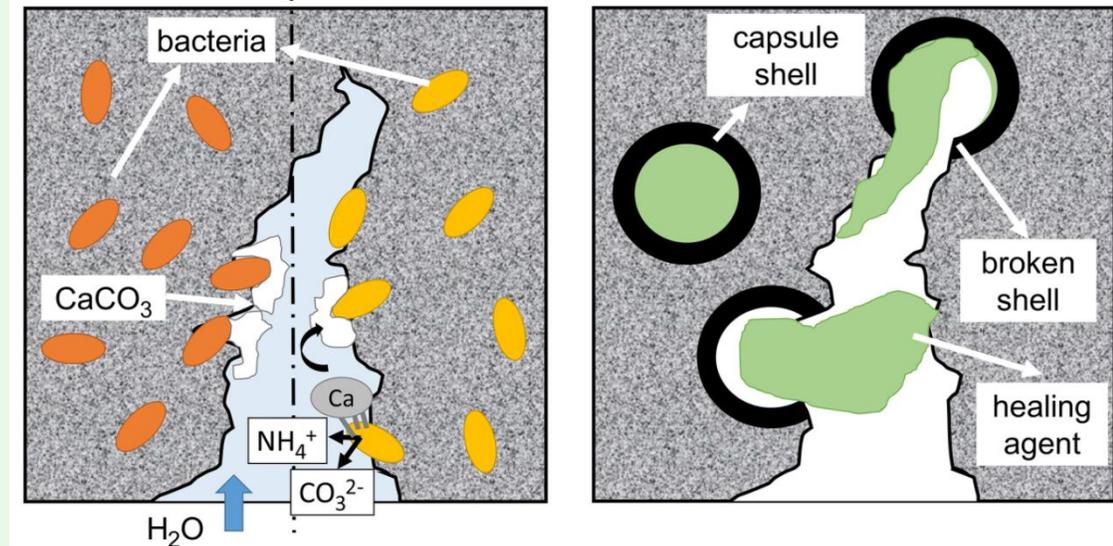
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Self healing strategies

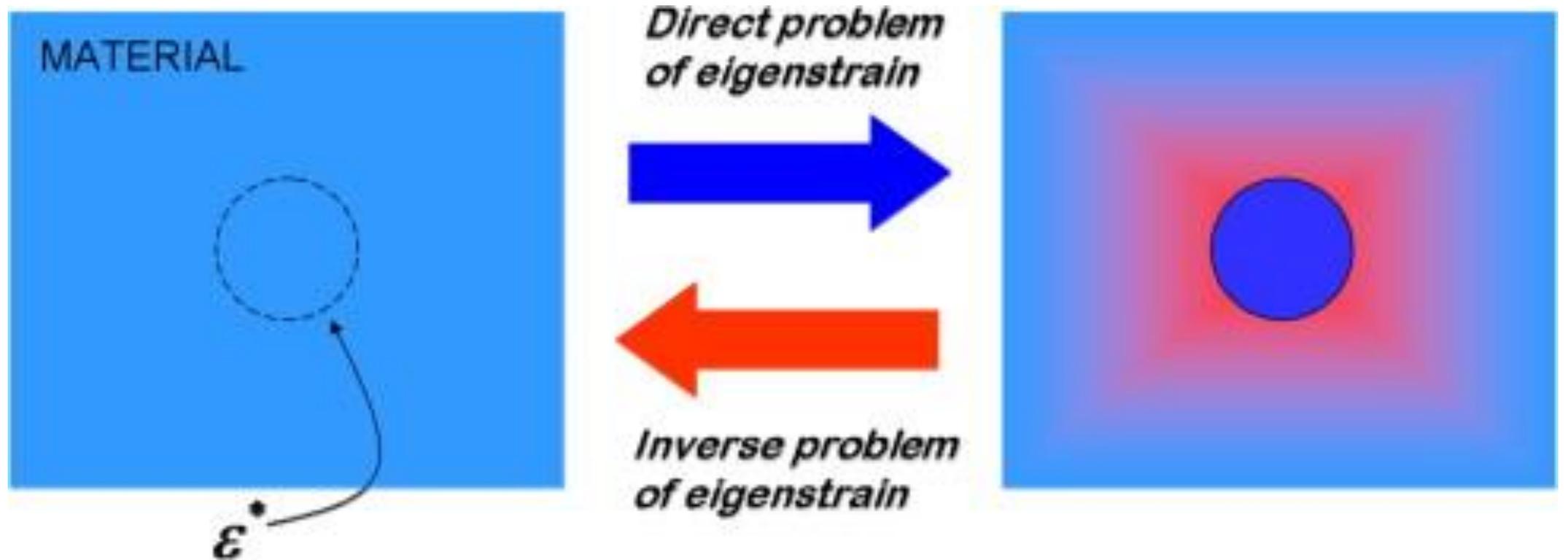
Autogenous healing of concrete



Autonomous healing of concrete



Eigen stress and eigen strain



Why do carrots curl?

From *Communications*

Why do carrots curl? Research reveals the mechanics behind root vegetable ageing

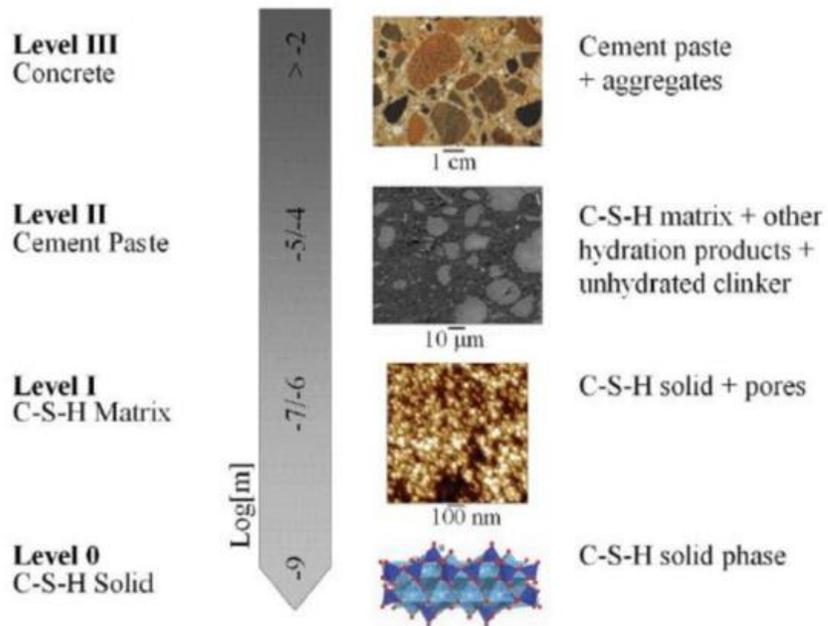
Undergraduate research conducted in a kitchen during lockdown could reduce food waste and help keep veg in prime condition for longer



Restrained vs non restrained

Restraining at different levels

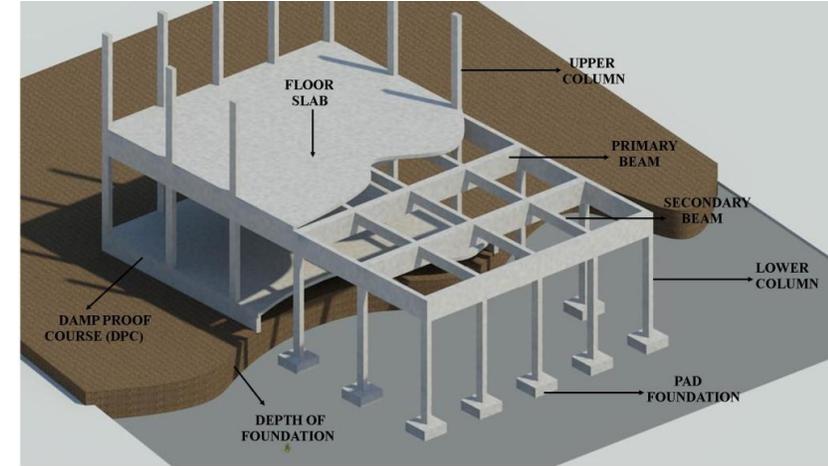
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Element



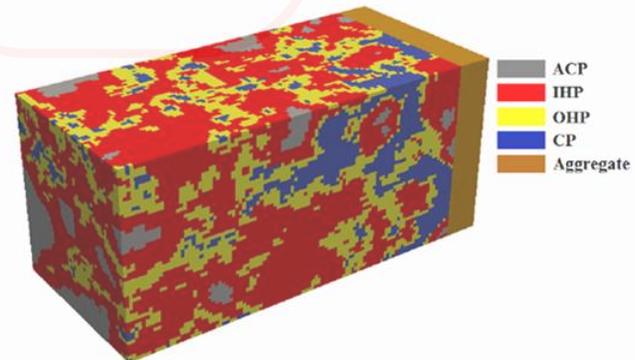
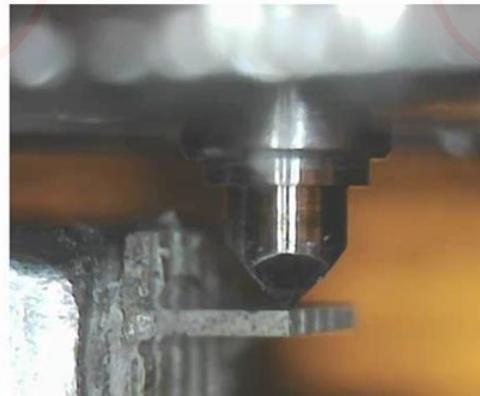
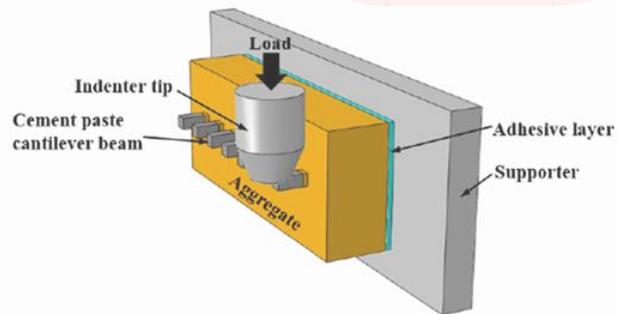
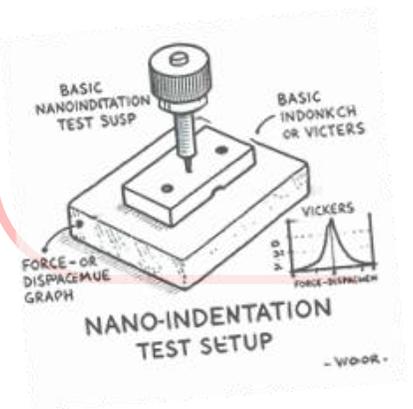
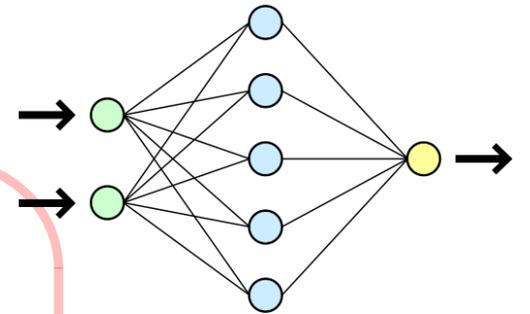
Structure



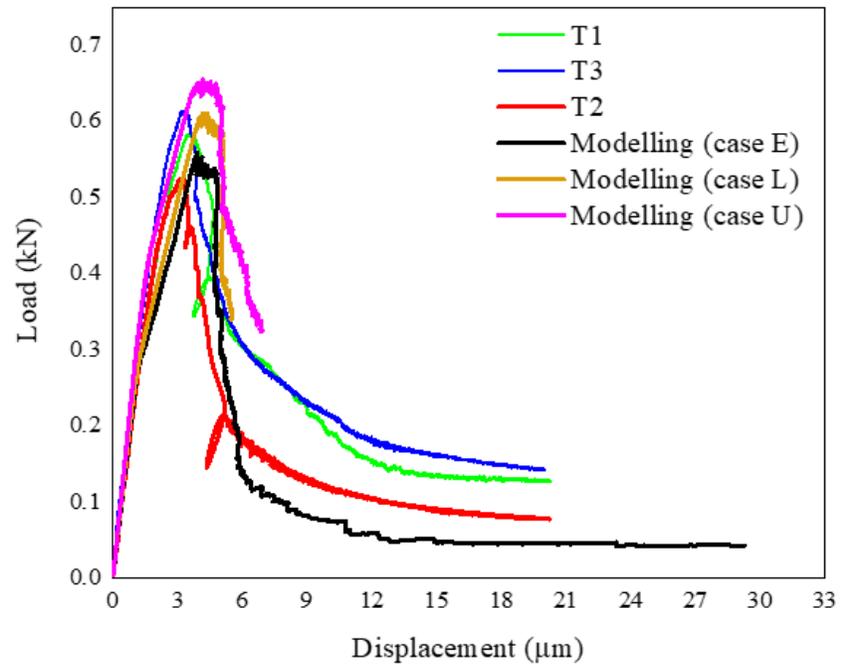
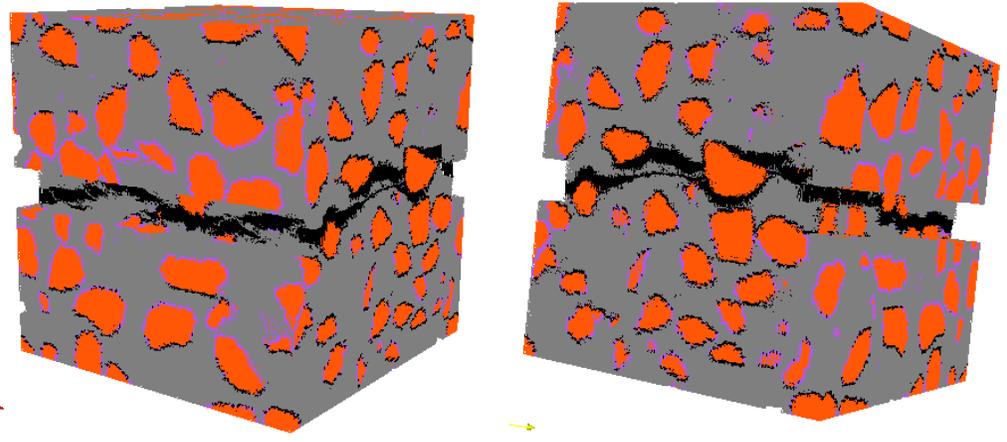
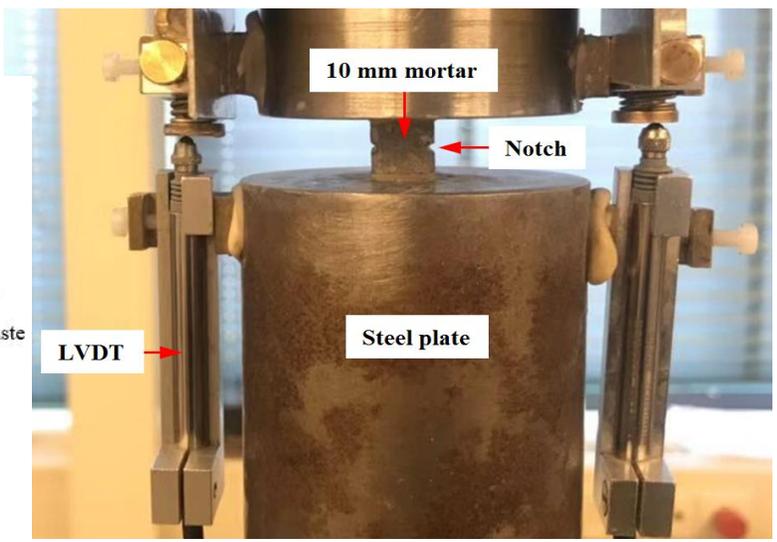
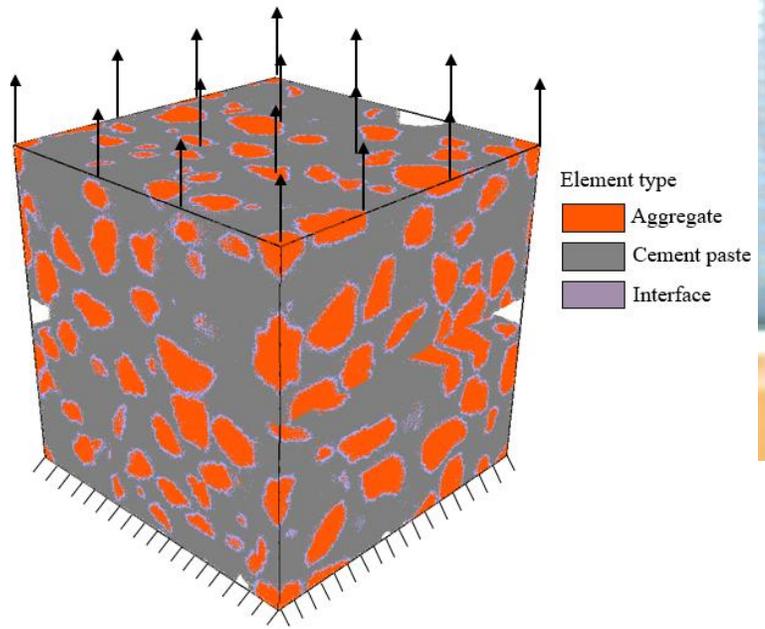
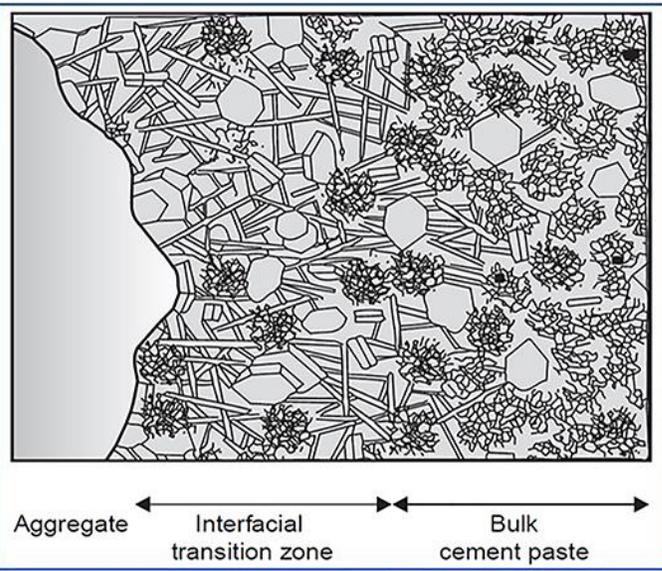
MAGICON

2027

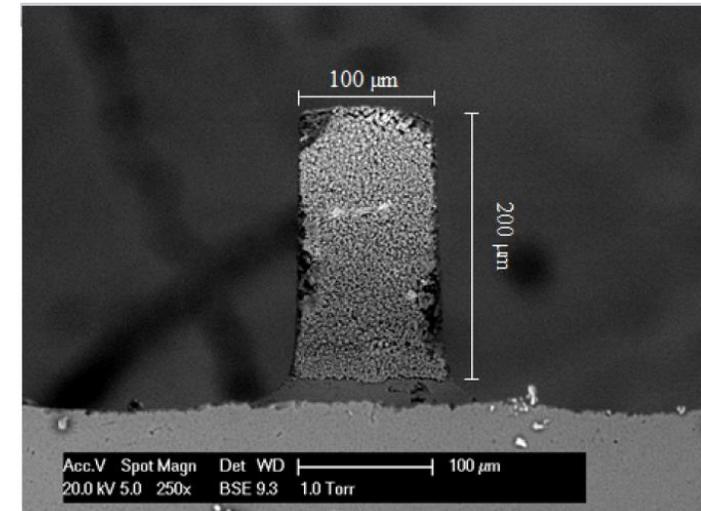
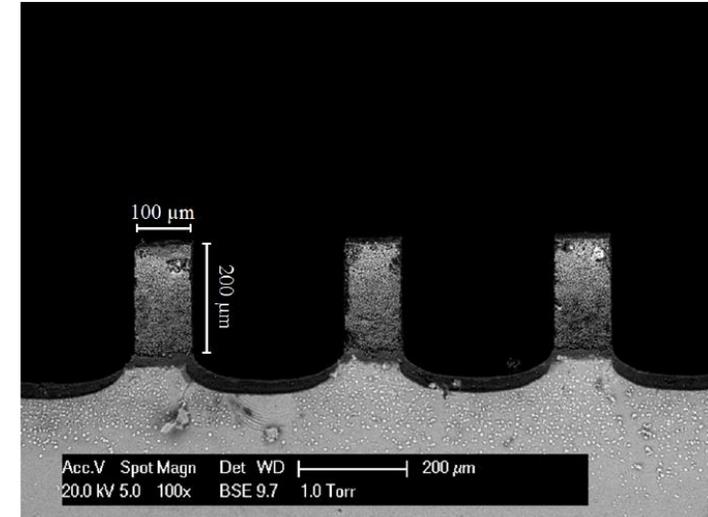
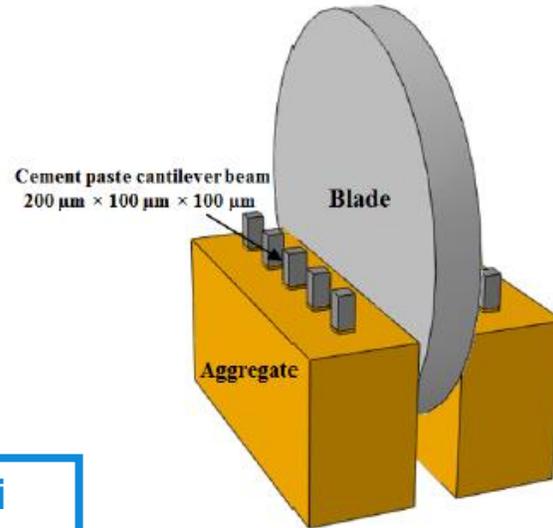
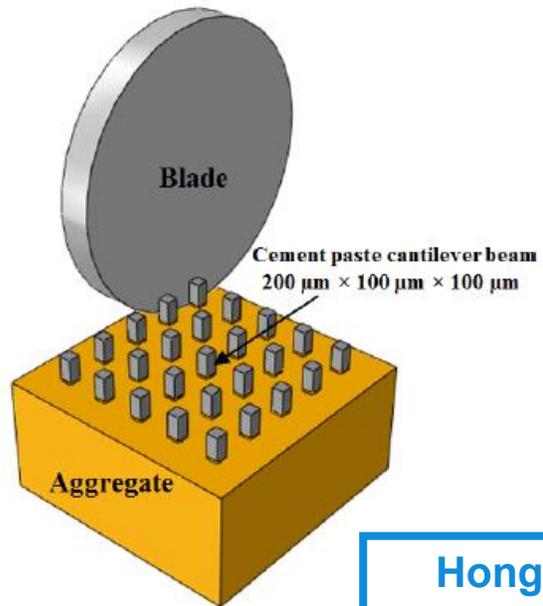
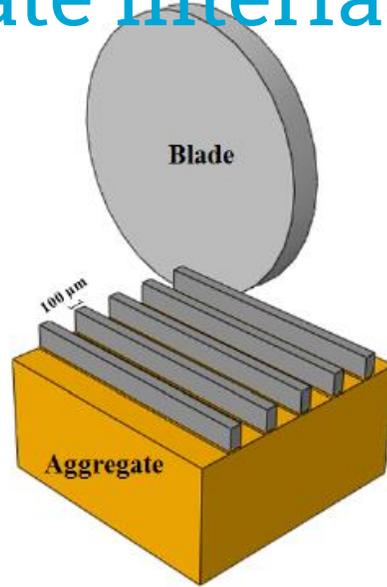
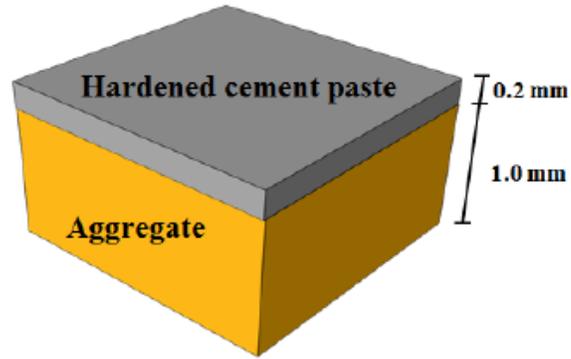
- ITZ micro-structure and
- Mechanical performance
- *Challenge*: measure eigen-stress
- Initial moisture tests
- AI for generation of ITZ-micro-structures



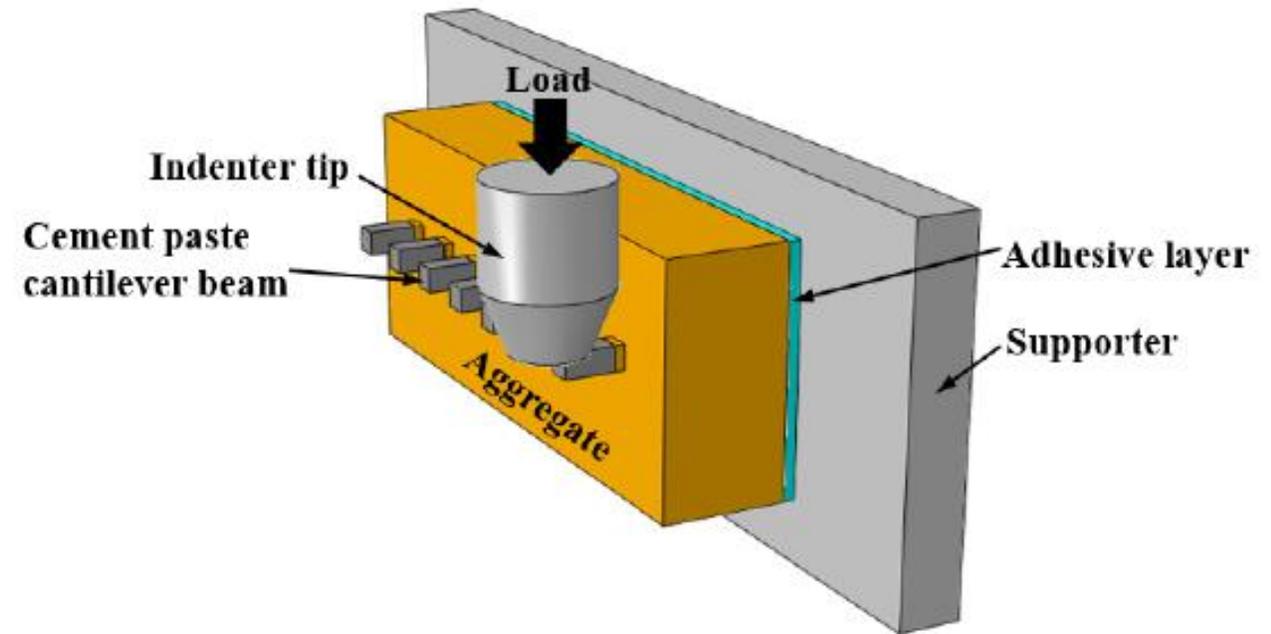
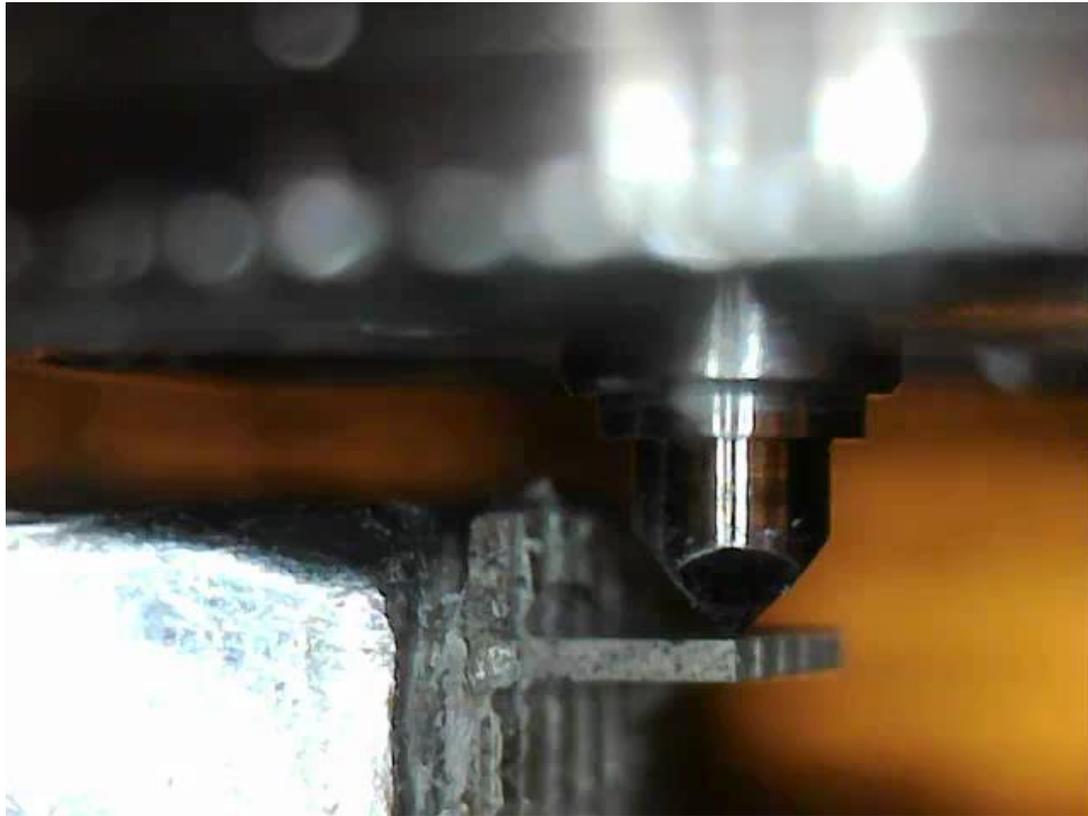
Cement-paste aggregate interface



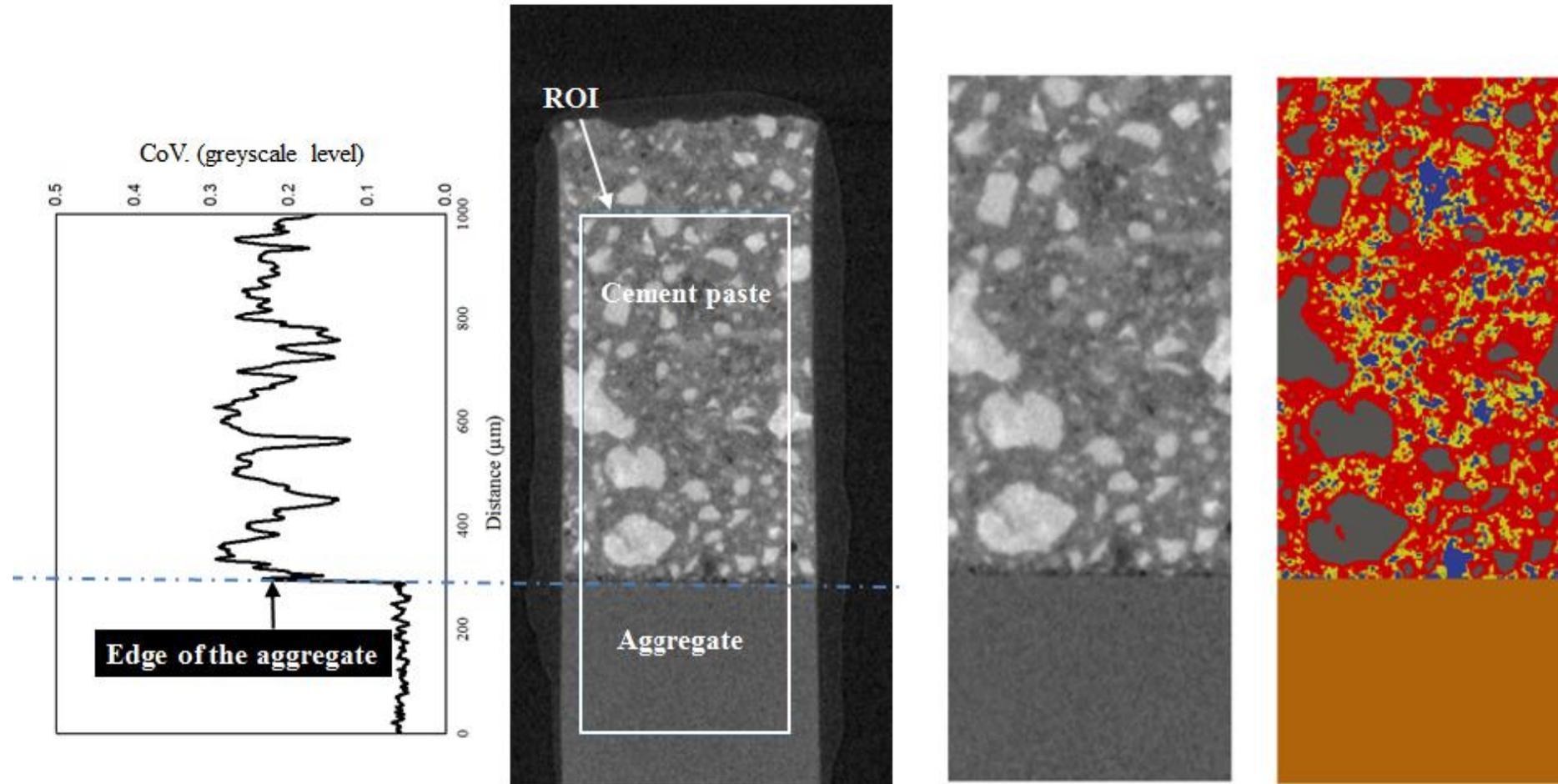
Cement-paste aggregate interface



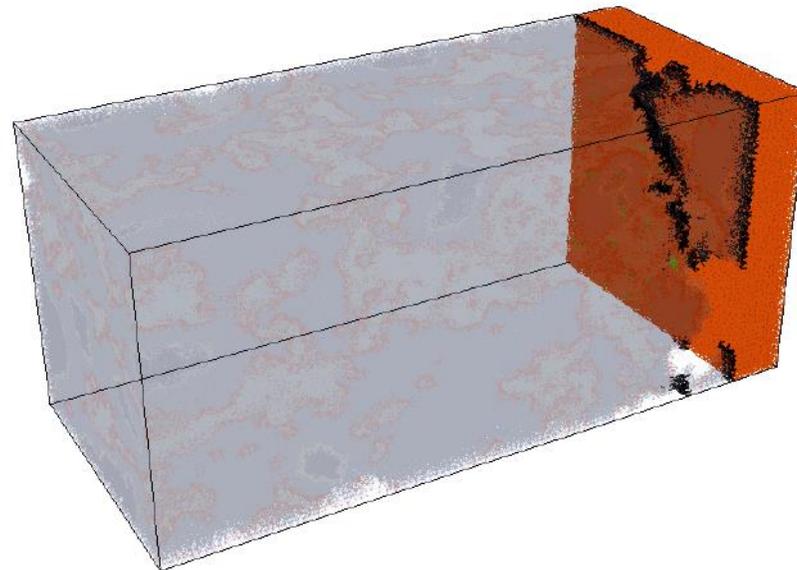
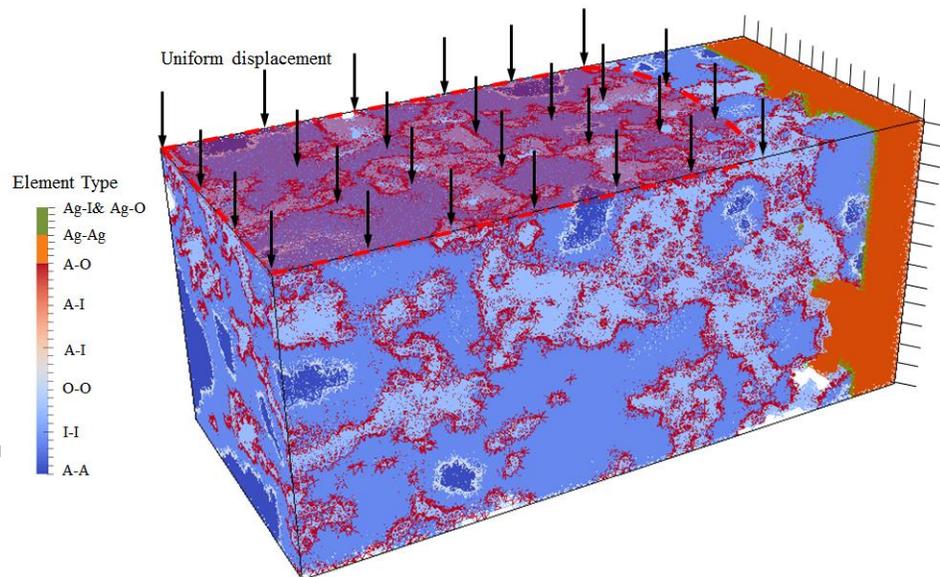
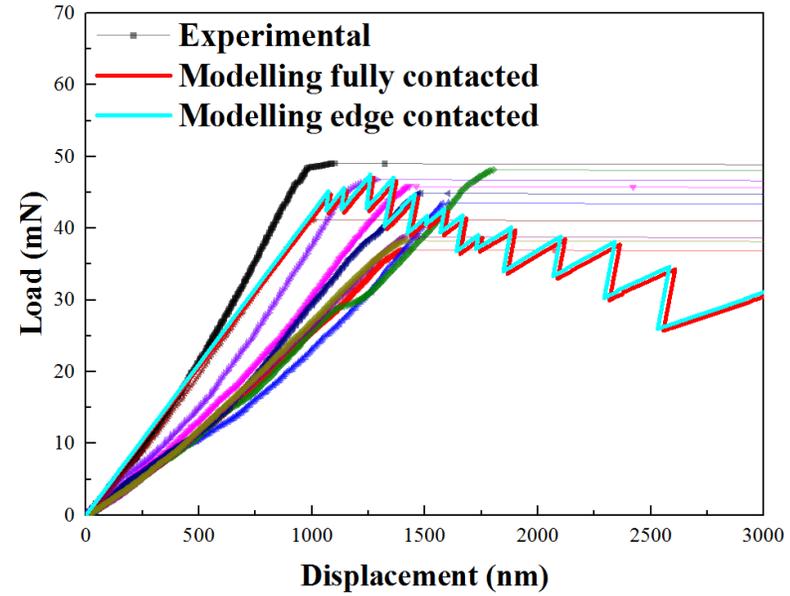
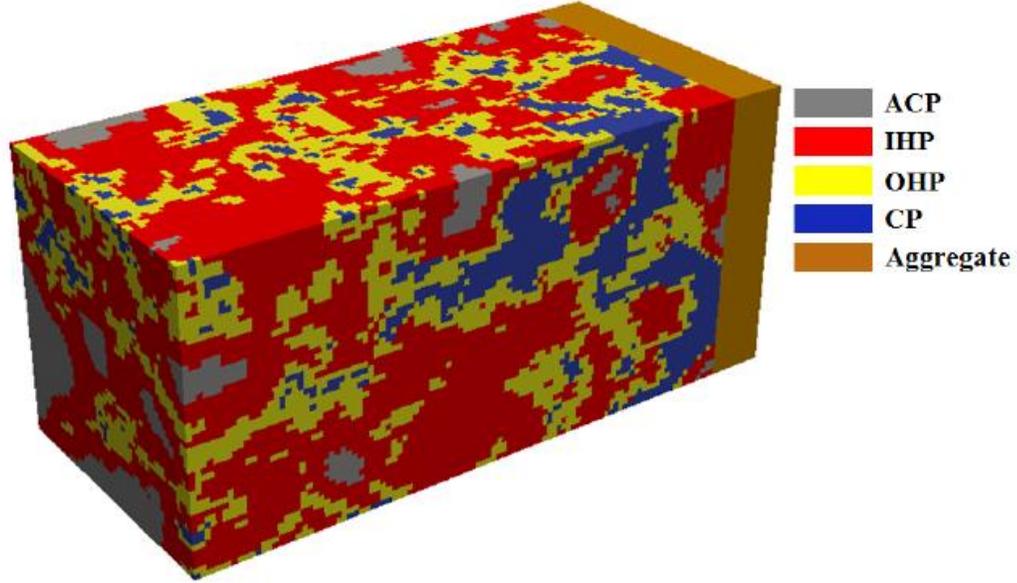
Cement-paste aggregate interface



Cement-paste aggregate interface

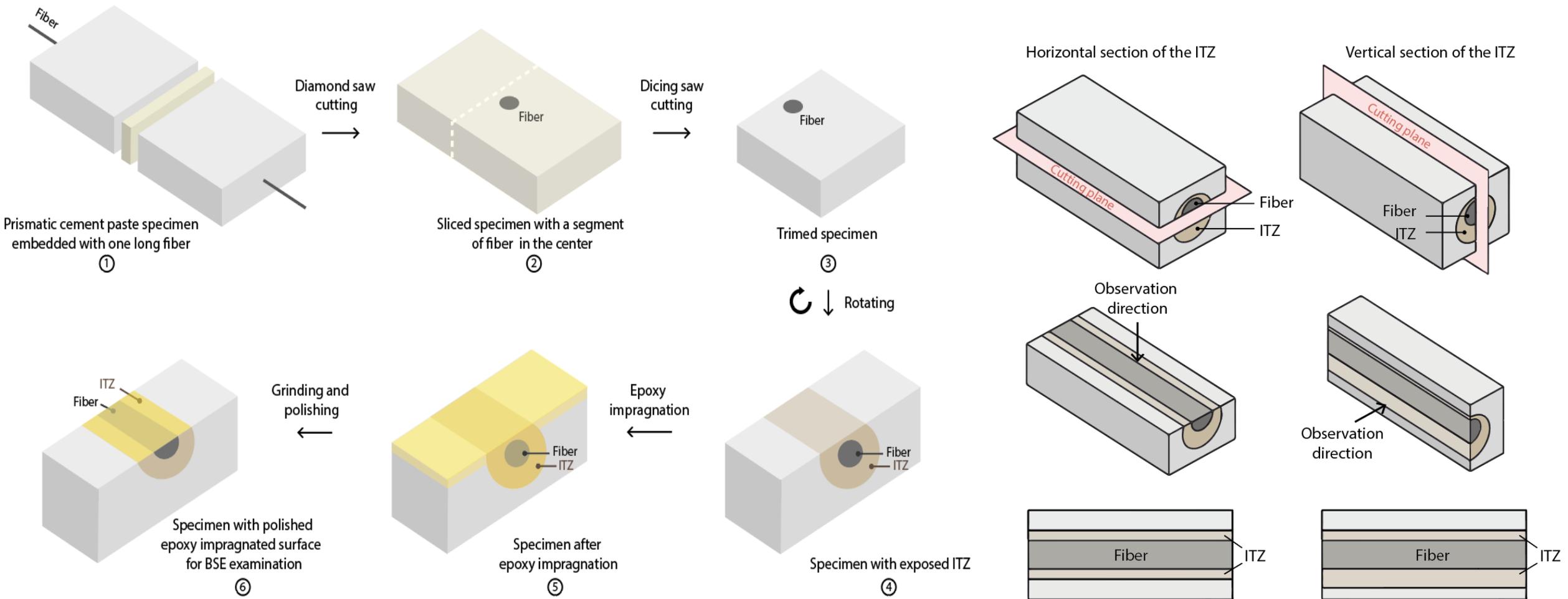


Cement-paste aggregate interface

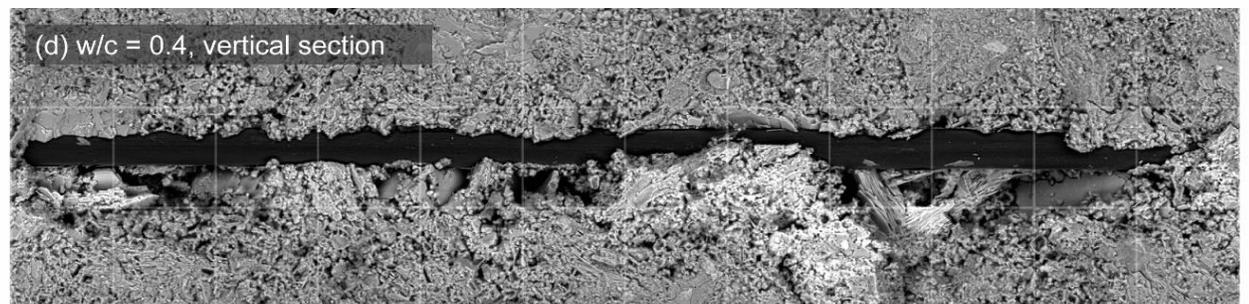
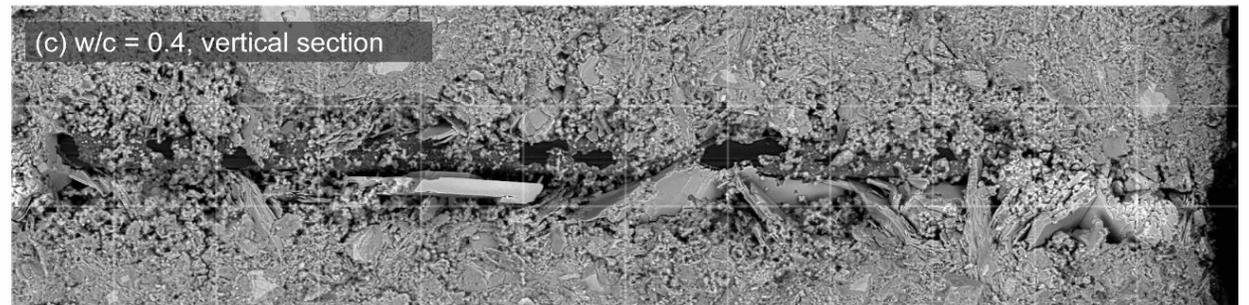
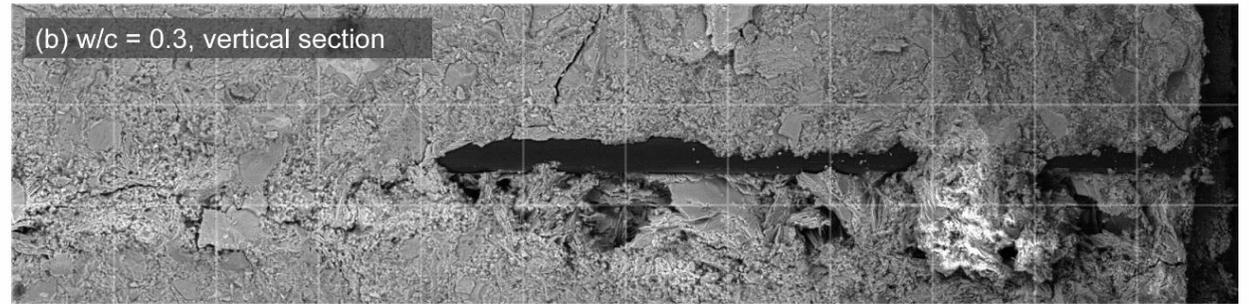
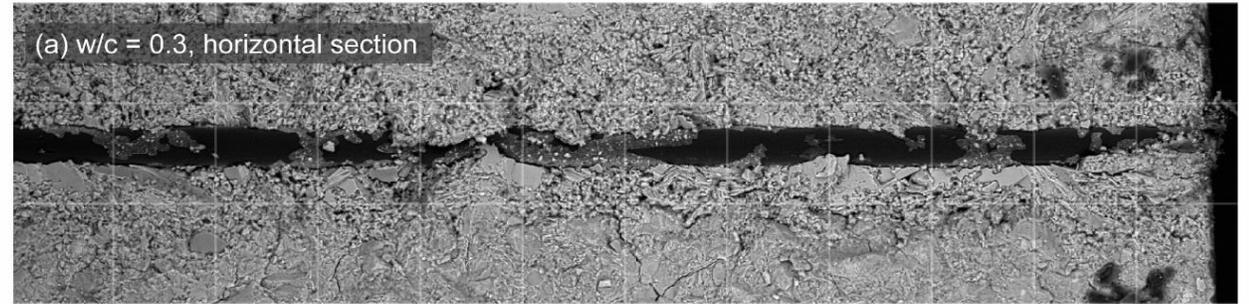
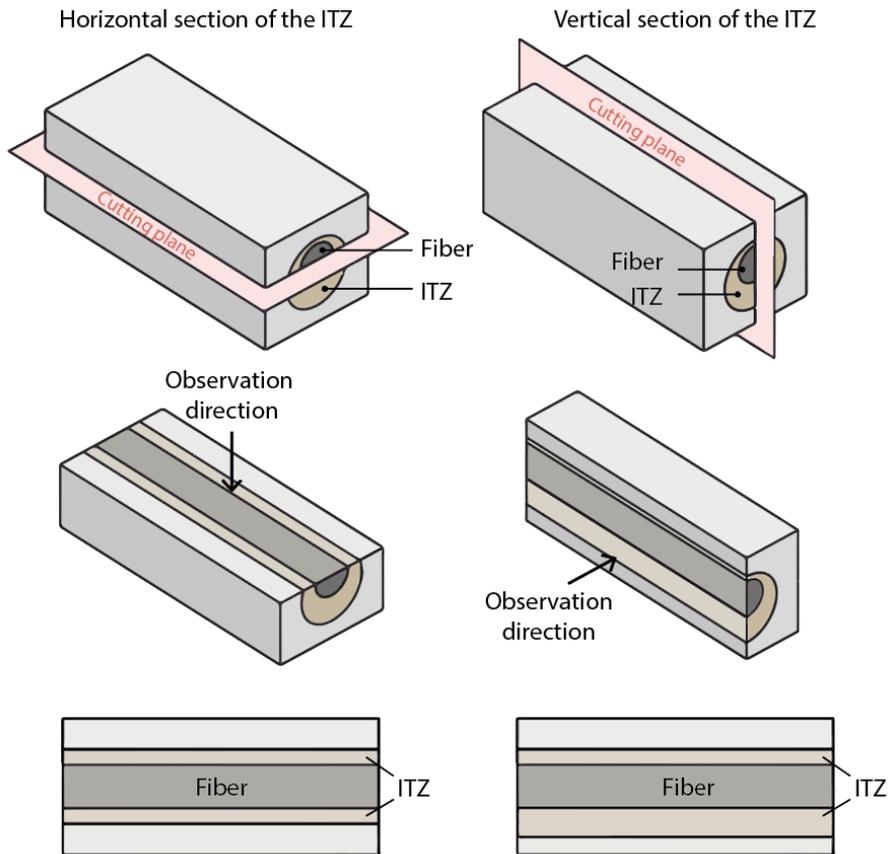


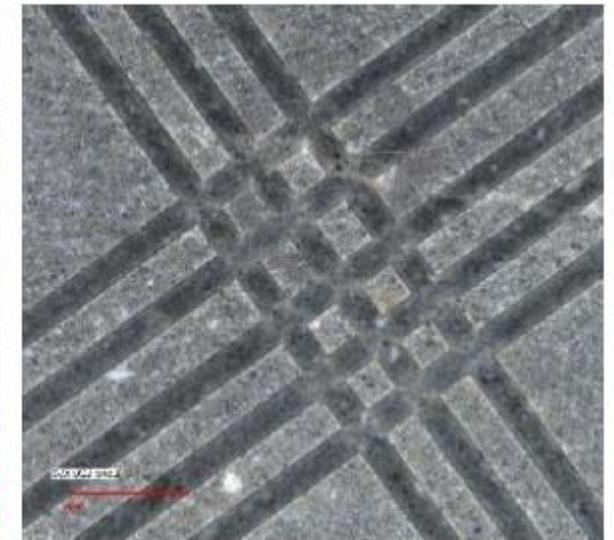
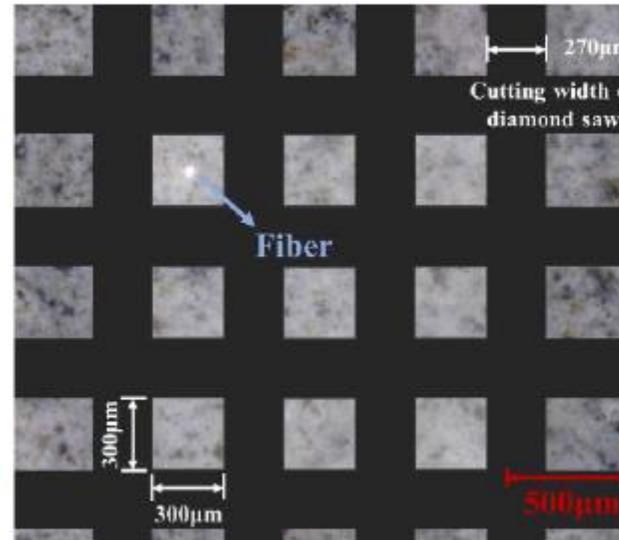
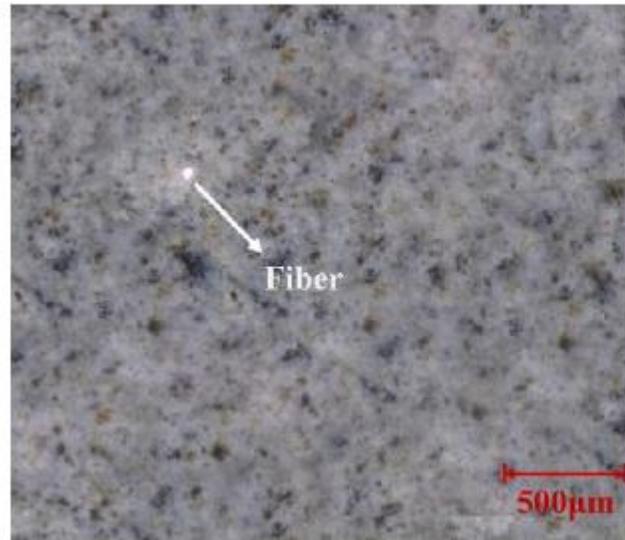
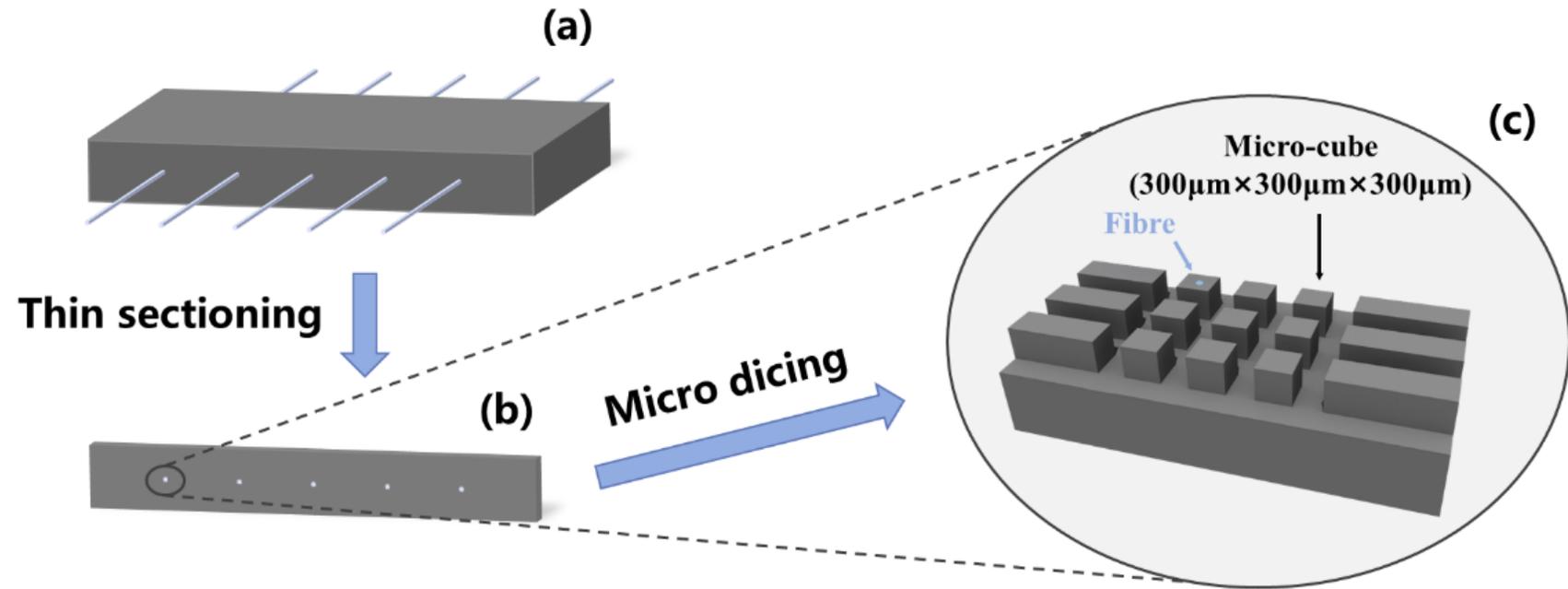
Hongzhi Zhang

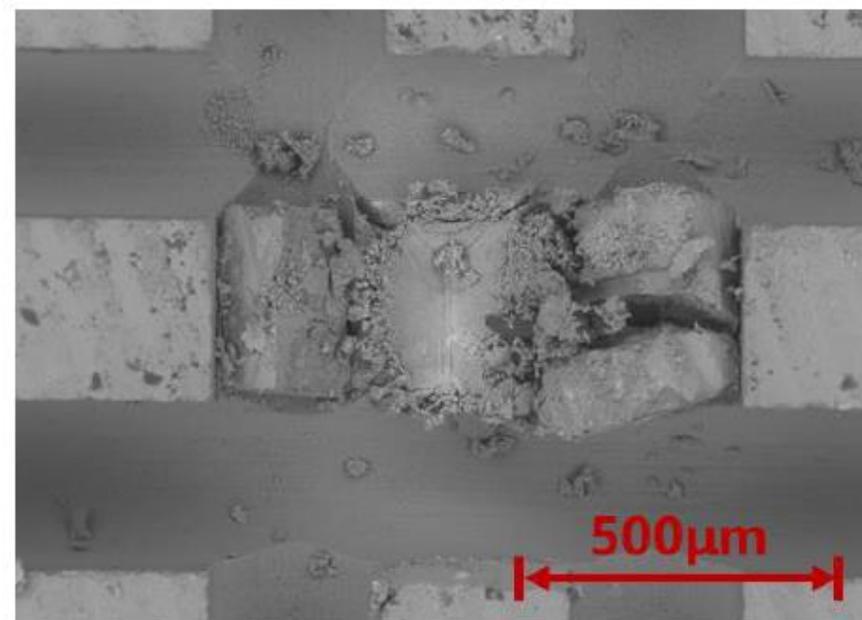
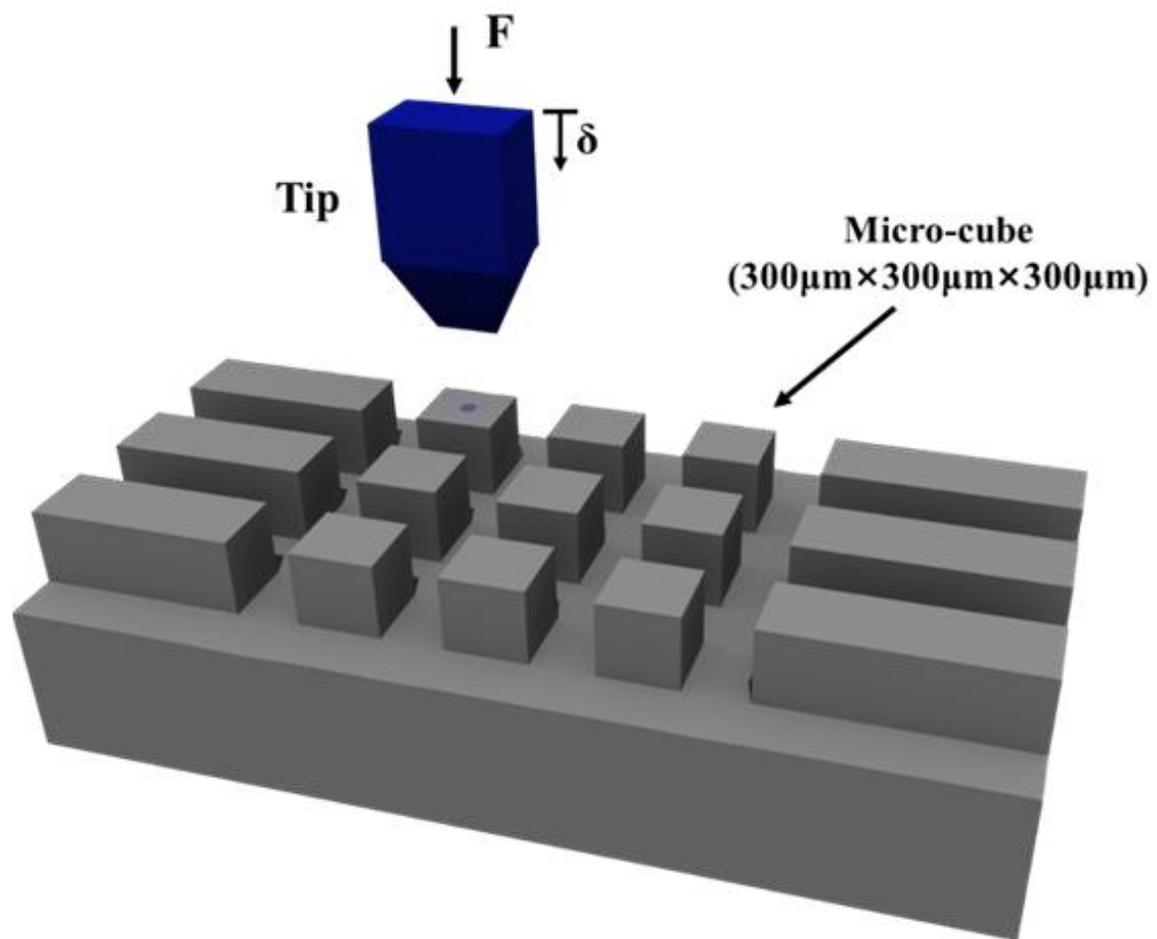
Fibre-cement interface



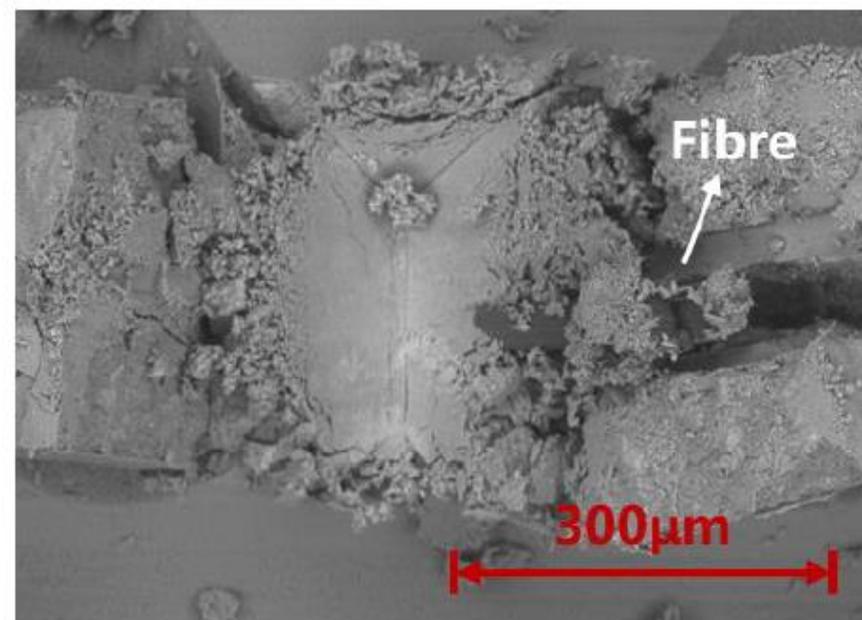
Fibre-cement interface





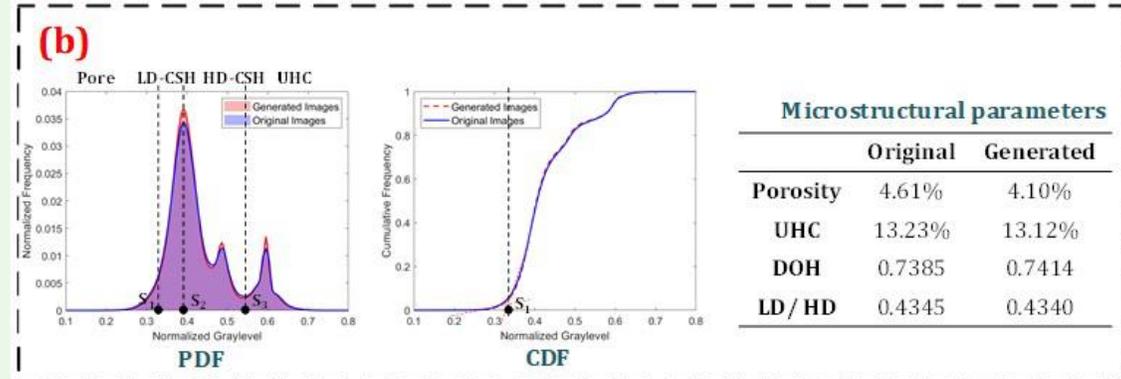
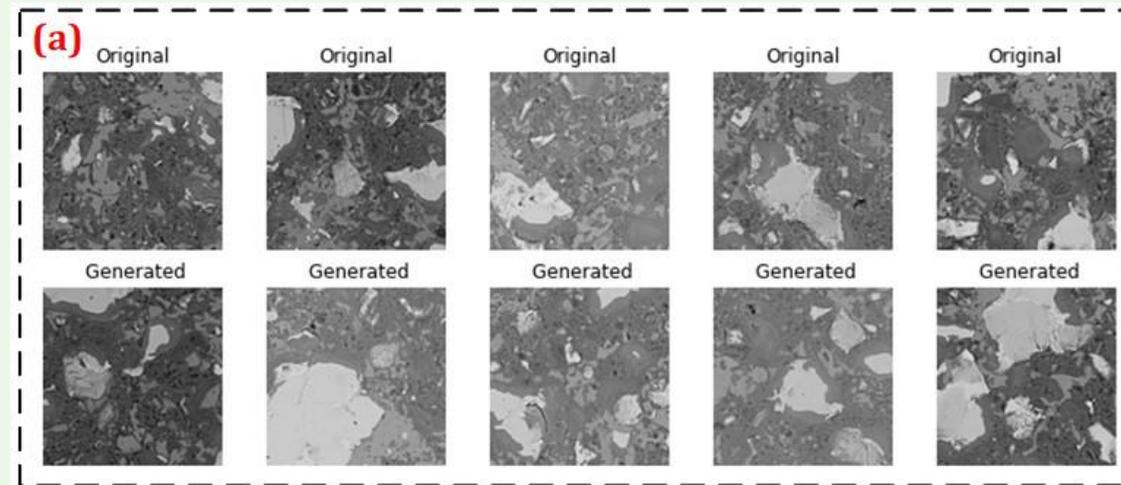
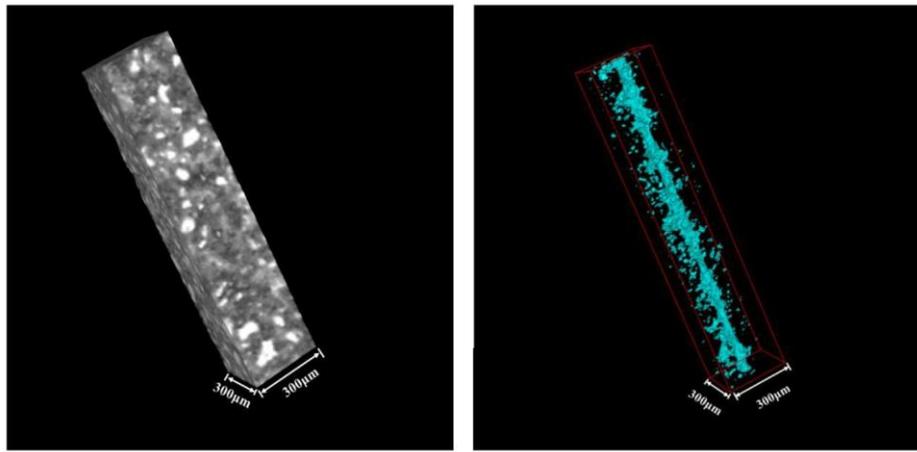


(b)



Capture microstructures

And use AI to multiply

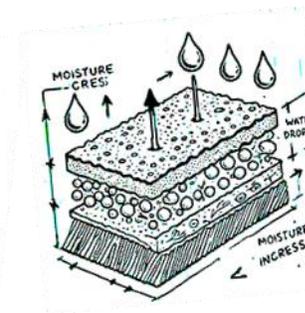
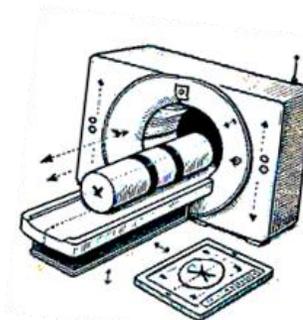
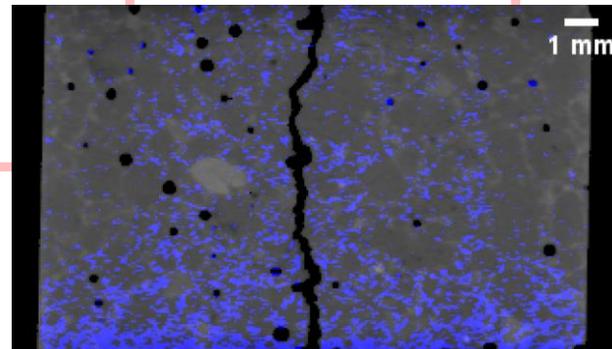
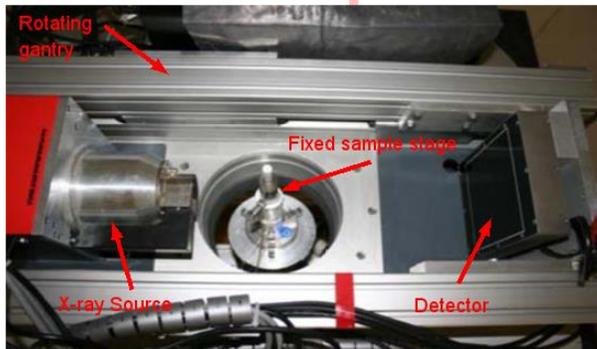


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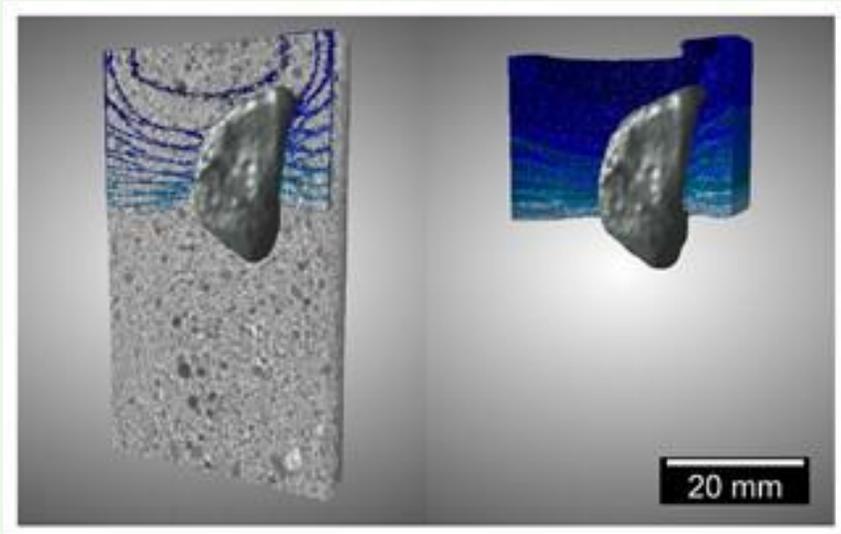
- **Challenge: ITZ-transport measurements**
- **Research stay of PI and PhD at other facilities**
- **Measure changing eigenstresses due to transport**



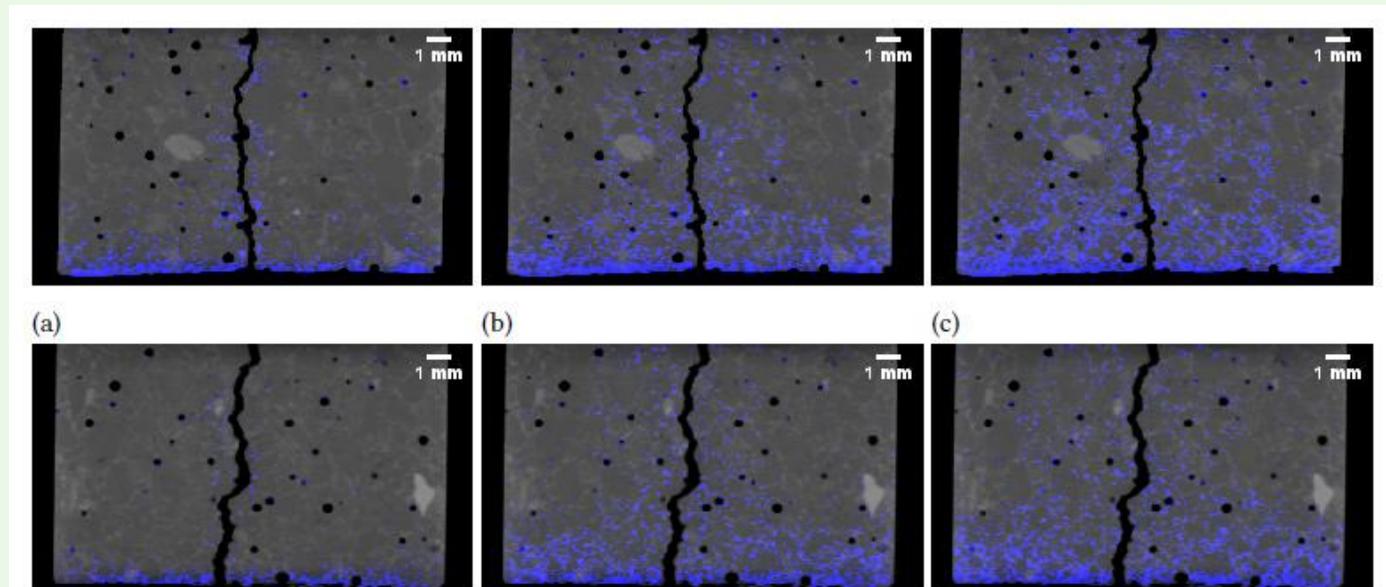
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Transport measurements



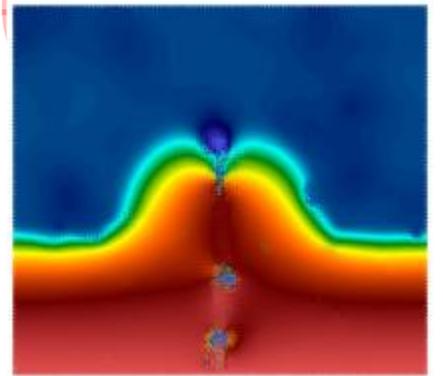
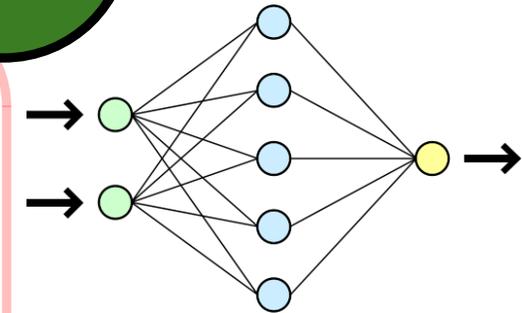
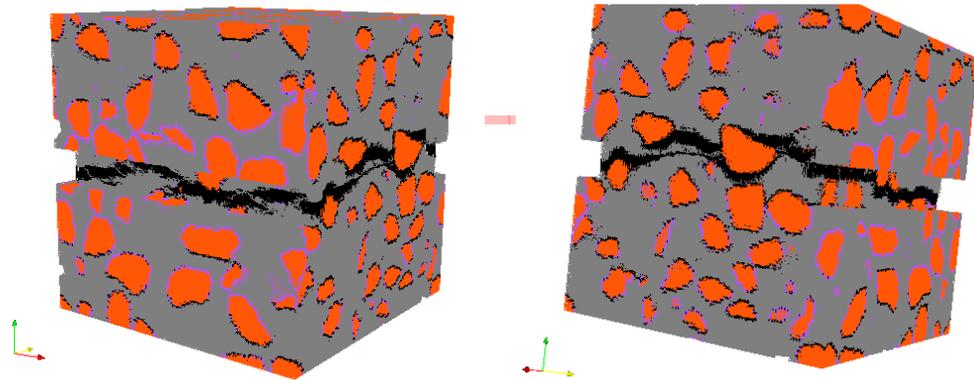
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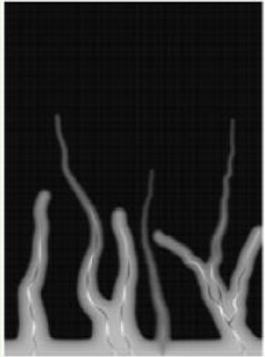
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- *Challenge:* AI modelling
- Deterministic and probabilistic simulations
- ITZ - transport, durability and fracture processes

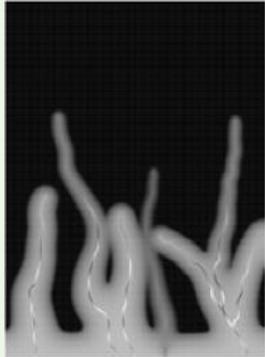
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Transport / Fracture / Eigenstress simulations



10 min

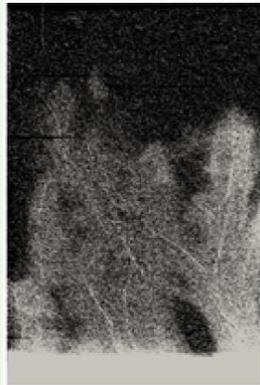
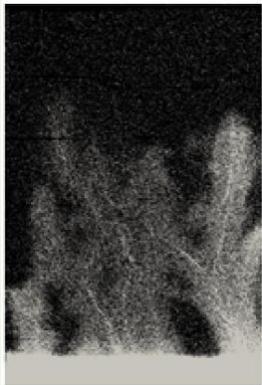
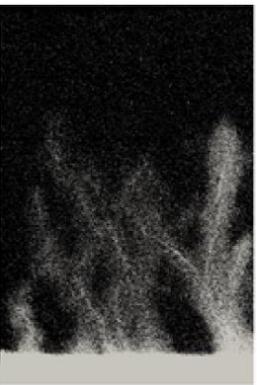


20 min

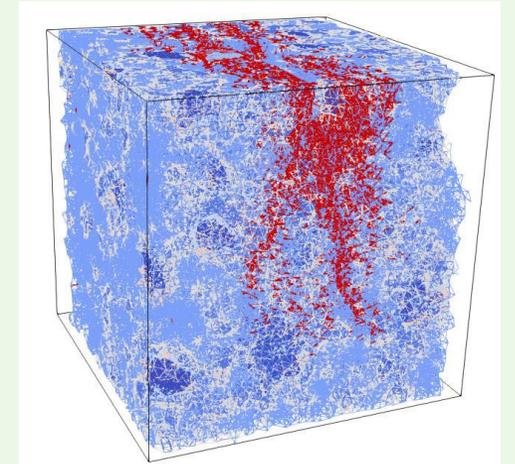
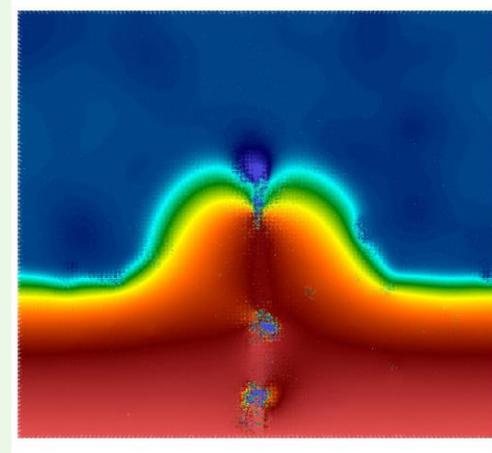
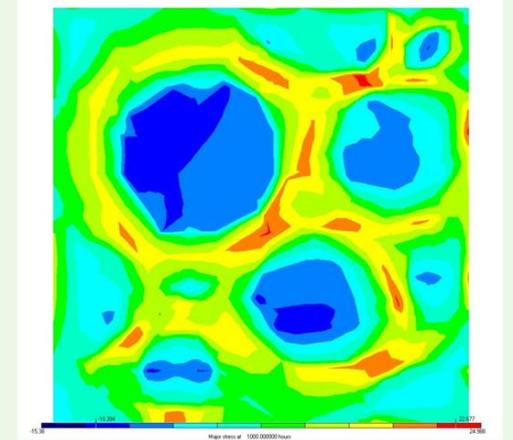
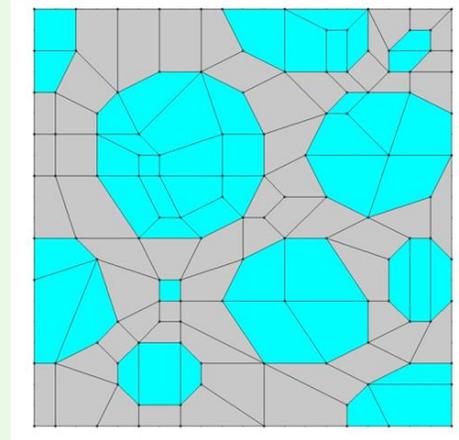


30 min

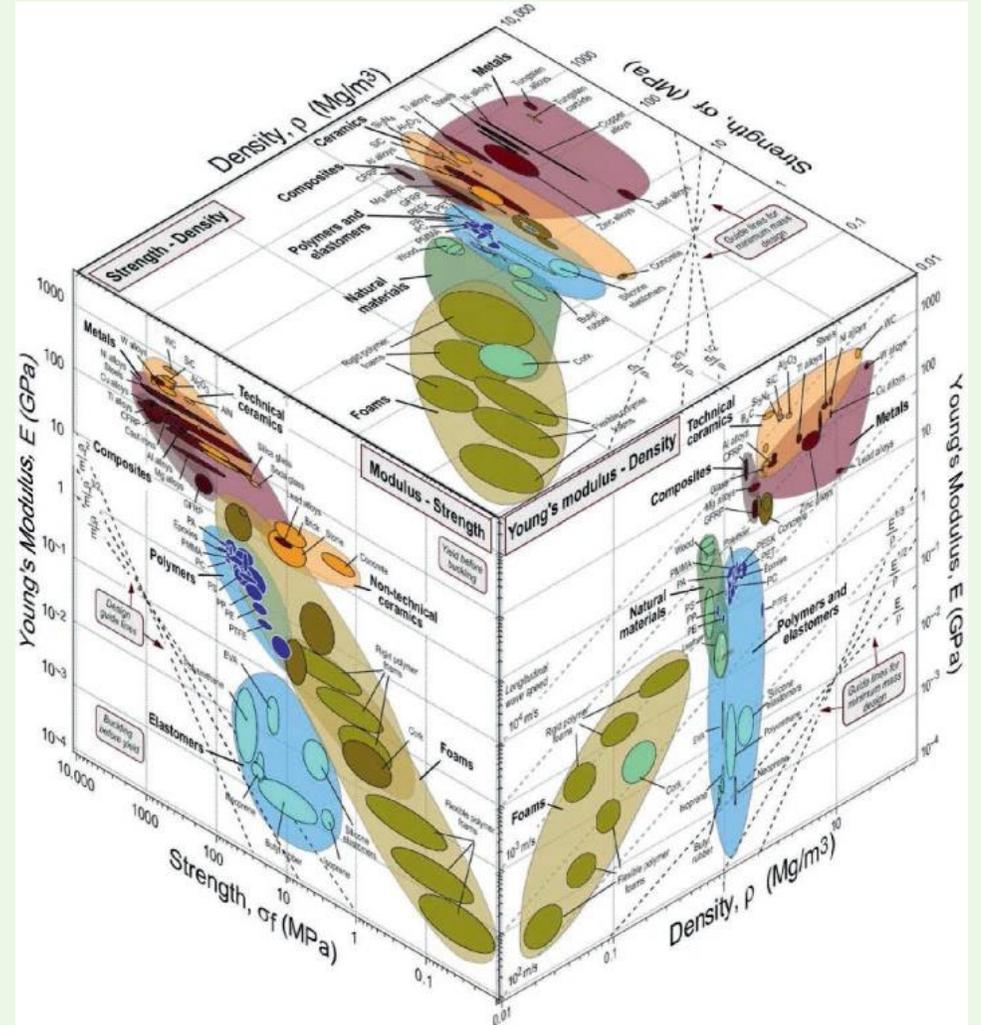
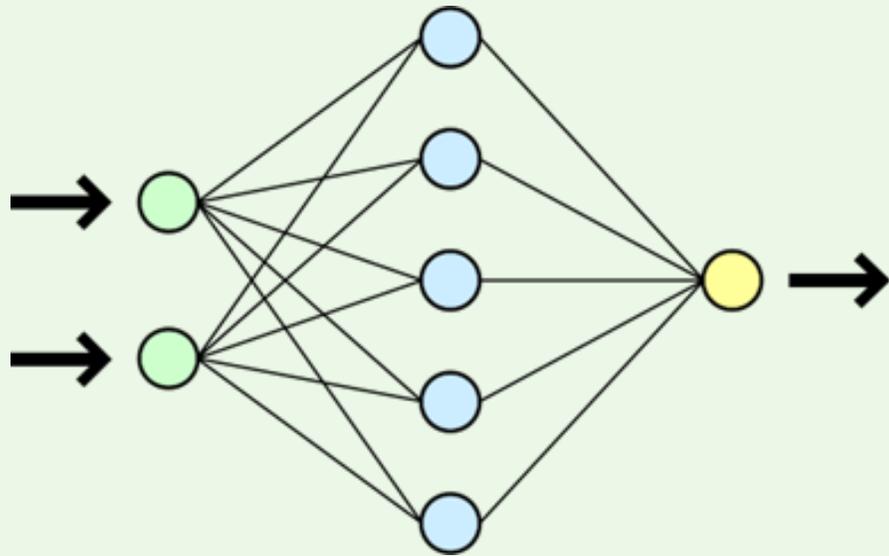
Simulation



Experiment
(strain=1.5%)

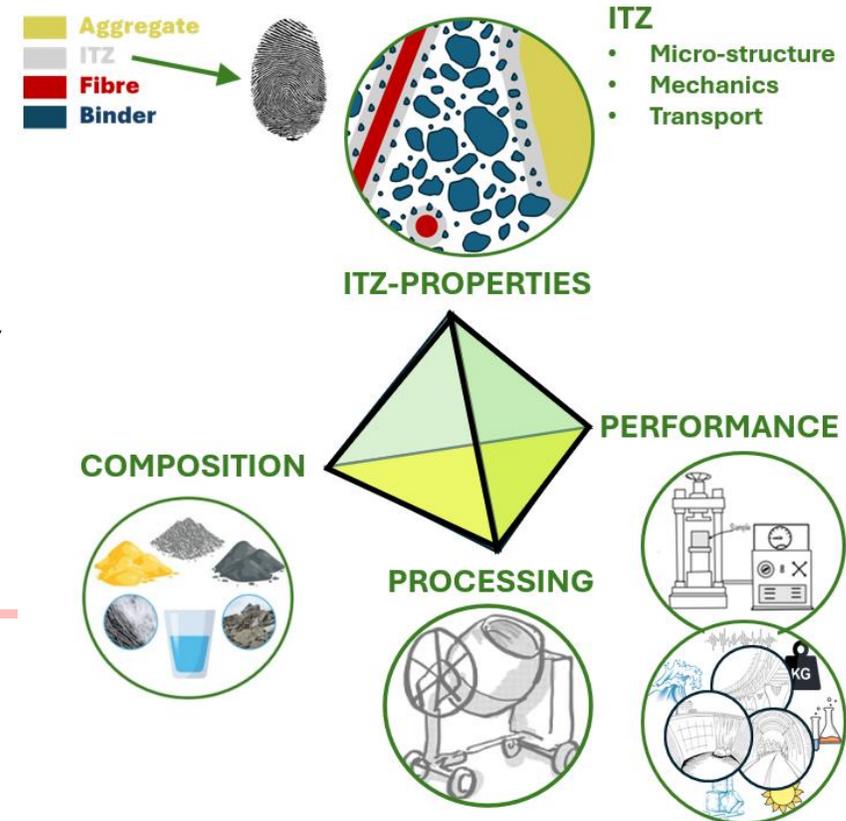


Ashby plots



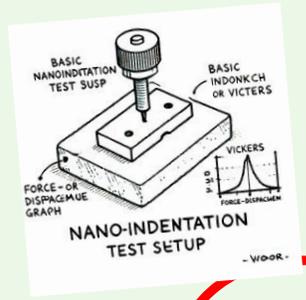
MAGICON

- MAGICON-Workshop
- 4 PhD's graduate
- Publications in top journals
- *Challenge*: Fingerprint strategy
- Performance tests
- Design guidelines
- Save structures with new 'green' materials



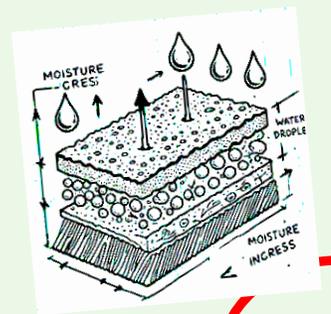
2025

INTERVIEW
RECRUITING
KICK OFF



2027

MECHANICAL TESTING
EIGEN STRESSES
CREEP



2029

NUMERICAL SIMULATIONS
AI MODELLING



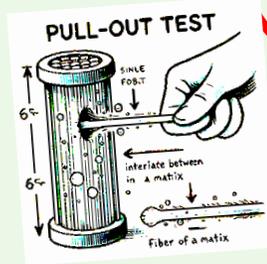
2026

DESIGN OF EXPERIMENTS
SELF-HEALING STRATEGIES



2028

MOISTURE TRANSPORT TESTING
DURABILITY



2030

PHD GRADUATIONS
WORKSHOP
CLOSURE

