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Testing mechanical and transport properties of ITZ in Concrete



Erik Schlangen, and the MAGICON-team



EMI 2026, September 2-4, 2026, Naples, Italy

Content

MAGICON



1. Explanation MAGICON
2. What do we want to measure
3. What are the various materials
4. How do we make samples
5. How do we test / model
6. What are results?
7. Future....

MAGICON team



1. **PI:** Erik Schlangen



2. **PD:** Shan He, Magdalena Rajczakowska



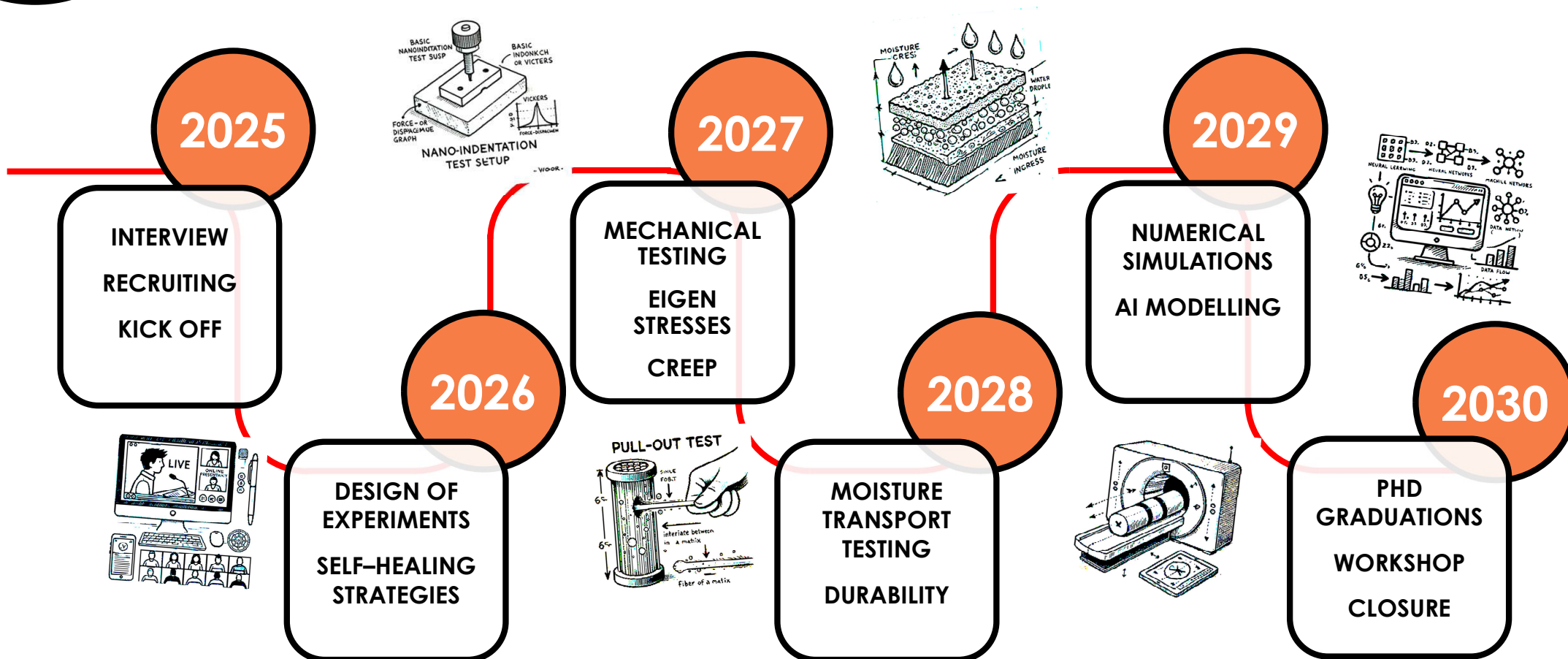
3. **PhD's:** Kangtai Yan, Arpan Adhikari, Jasmin van Riggelen, Kelsey Lin



4. **Technicians:** Arjan Thijssen, Maiko van Leeuwen

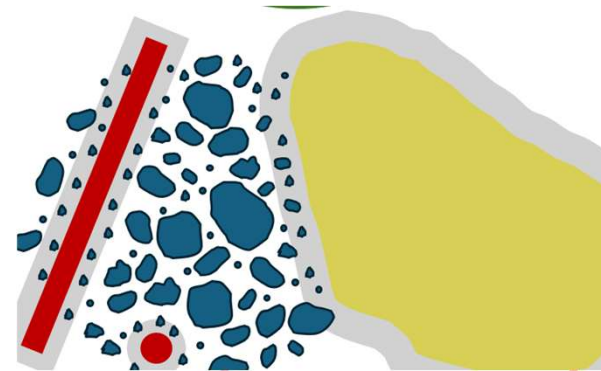


5. **Co-supervisors:** Iuri Rochas, Branko Šavija



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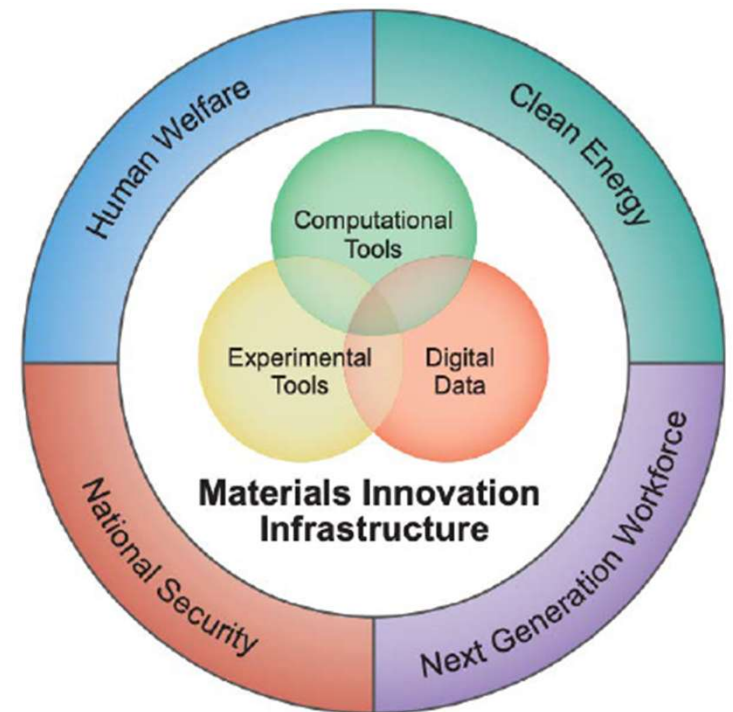
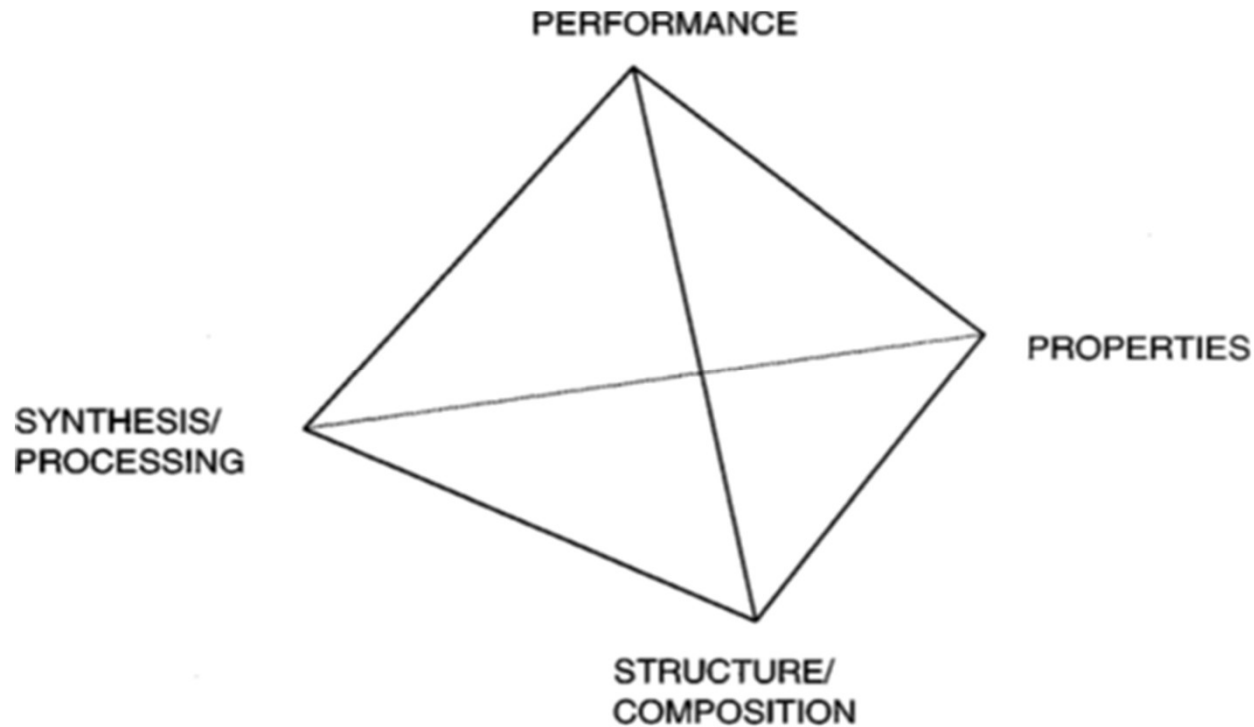
2025



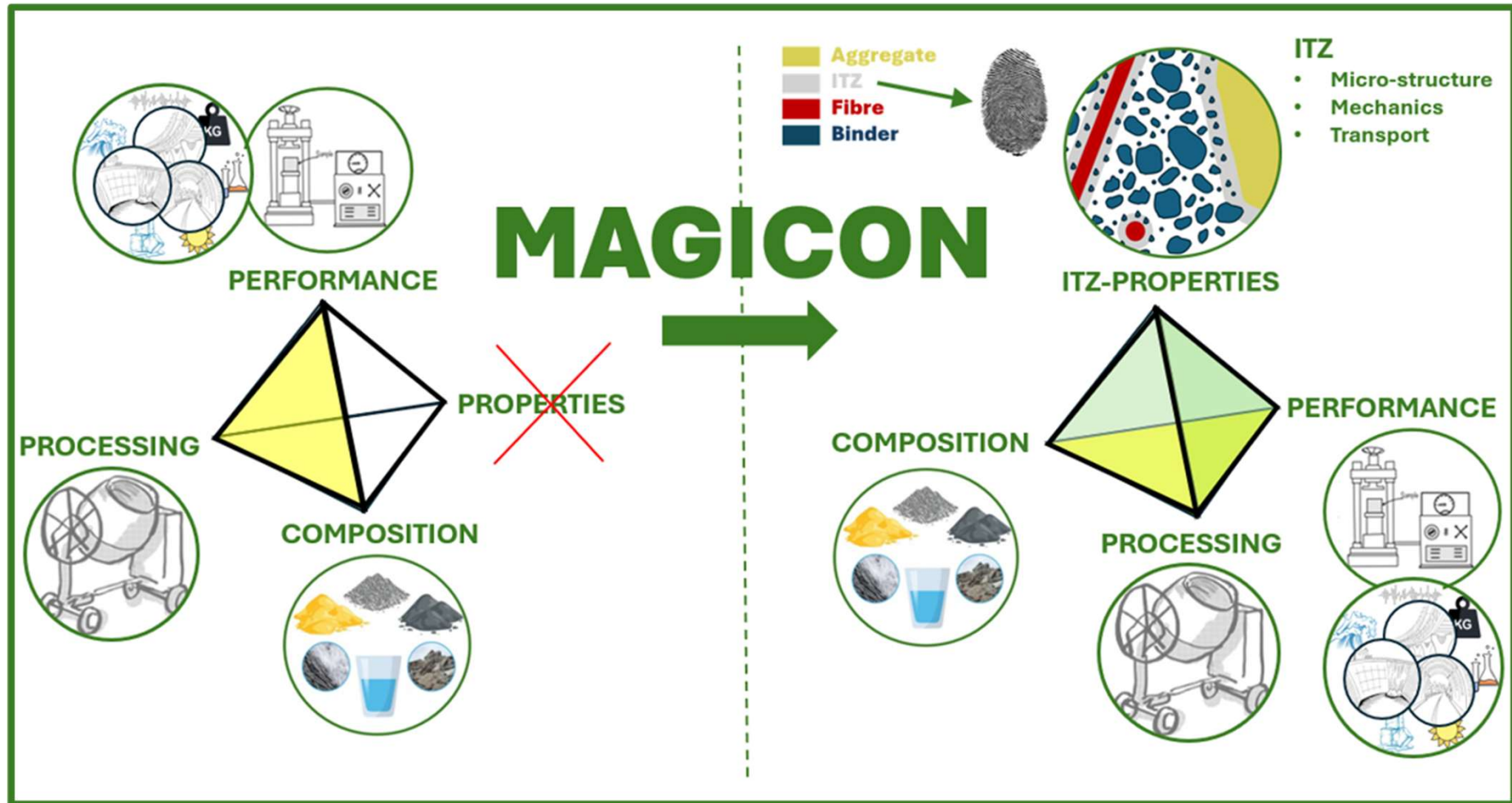
- **MAterials Genome engineering for re-Inventing CONcrete**
- **March 18th: Interview ERC-Panel-PE8**
- **June 15th: MAGICON is Granted**
- **Launching MAGICON-website www.erc-magicon.eu**
- **Contacting peers/competitors**
- **Selecting PhD's and Postdocs**



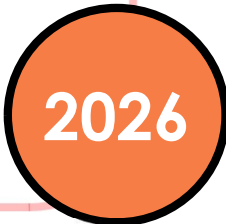
Genome Engineering

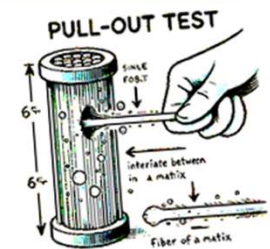
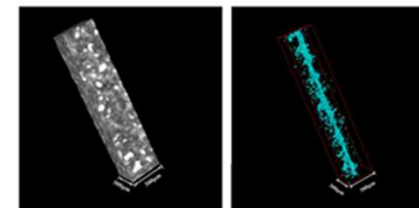
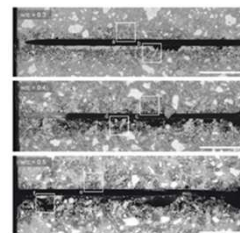
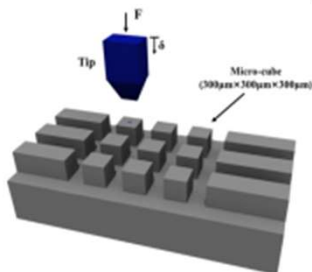
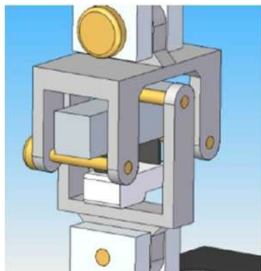
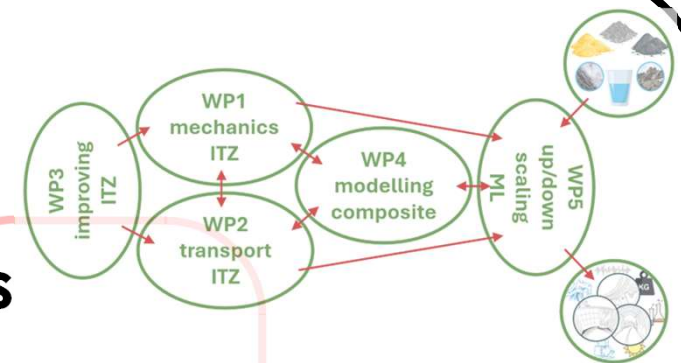


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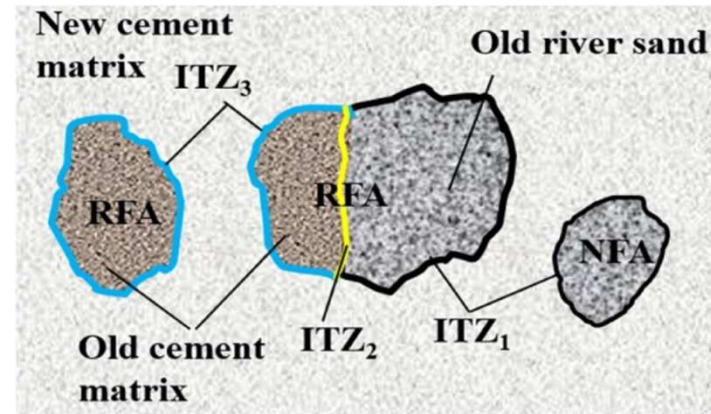
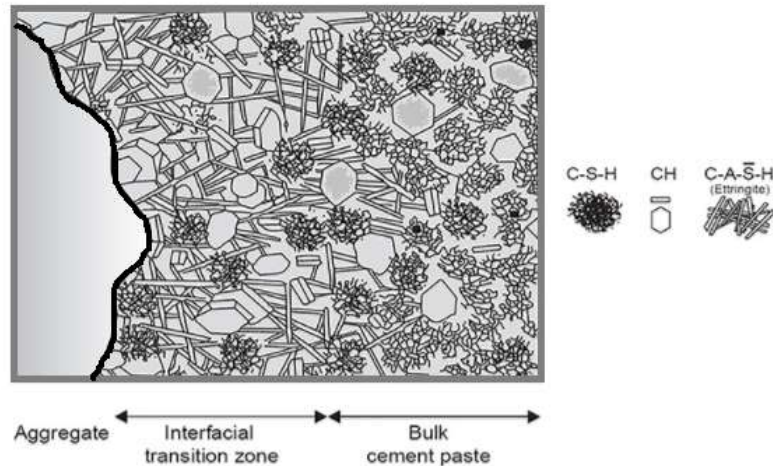


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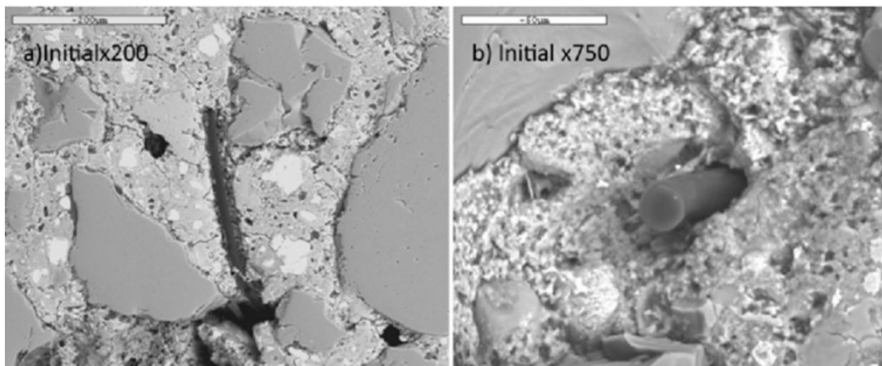
- **GOAL** (       )
- **Design of experiments**
- **Challenge: Design self-healing strategies**
- **Challenge: Make samples with eigen-stresses**
- **Design and**  **building climate chambers**



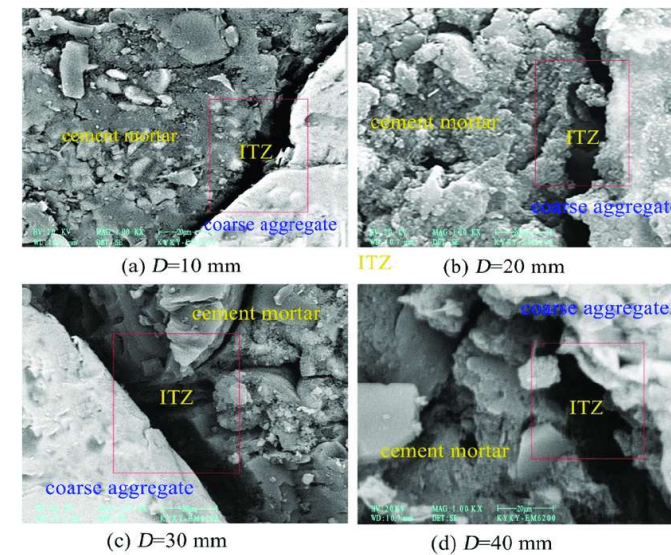
Select materials



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



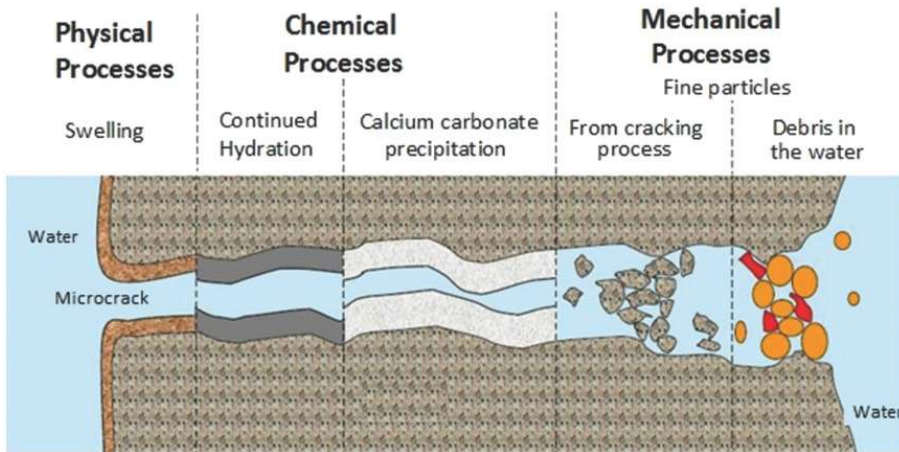
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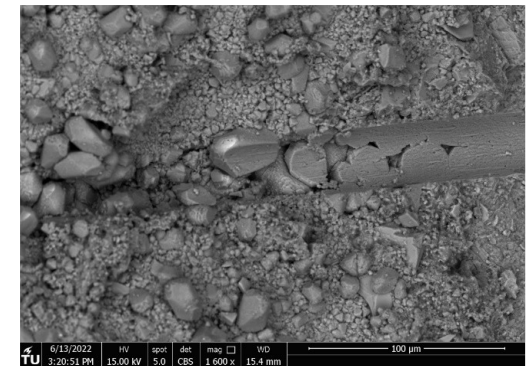
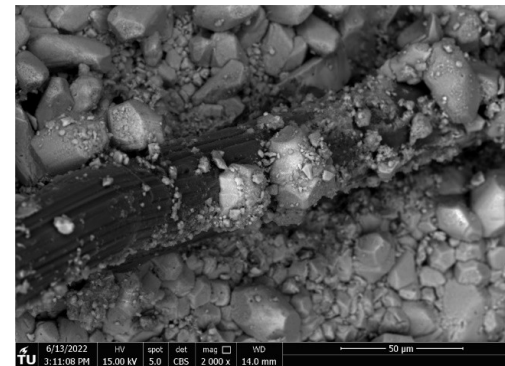
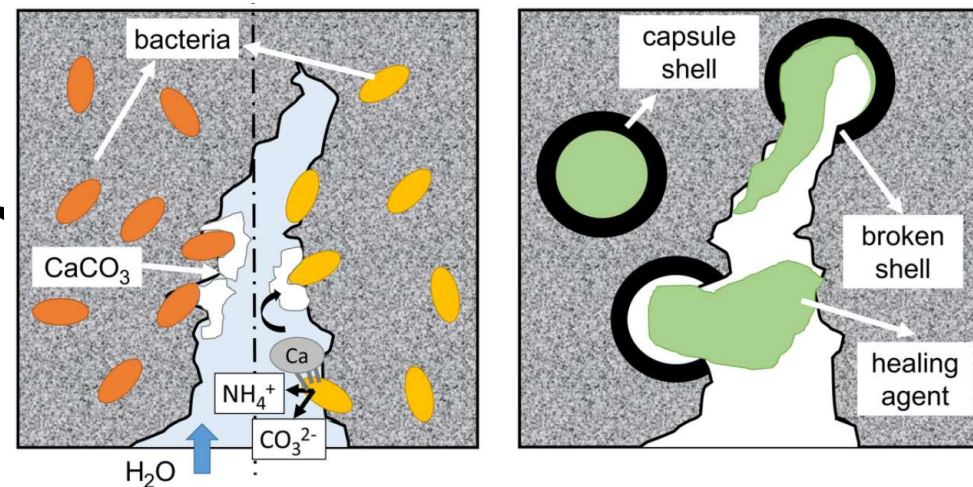
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Implement self healing options

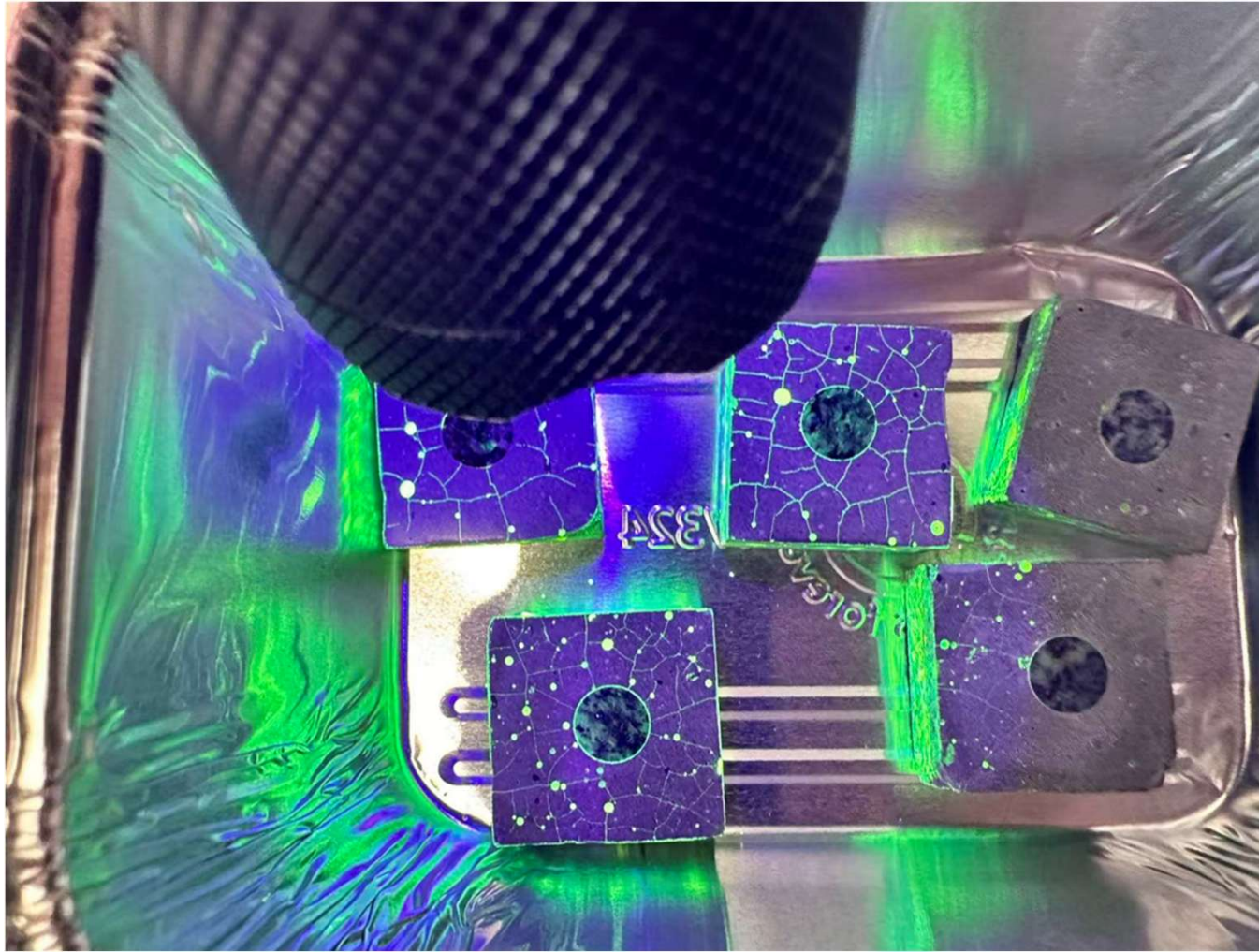
Autogenous healing of concrete



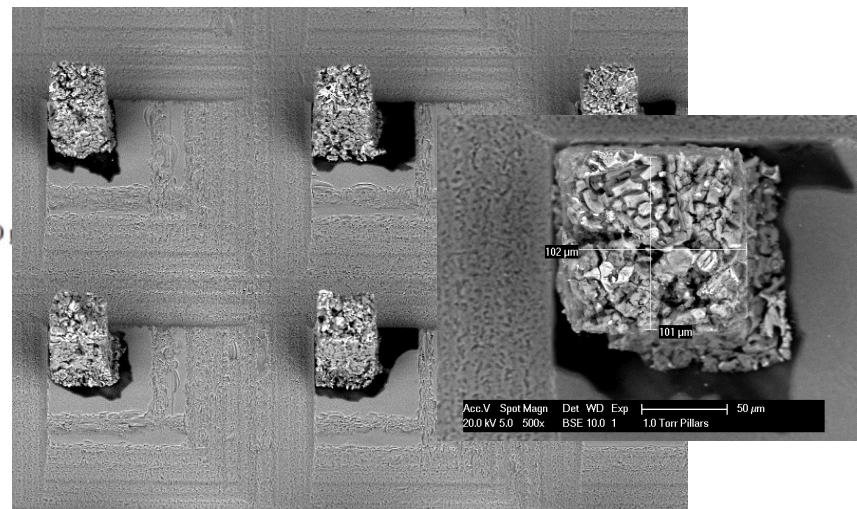
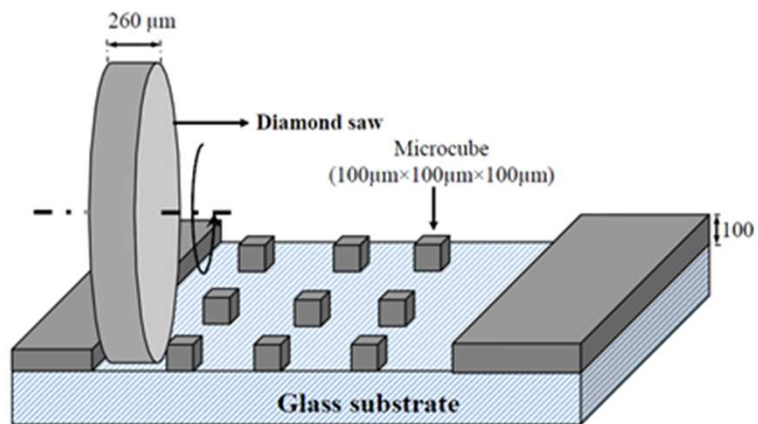
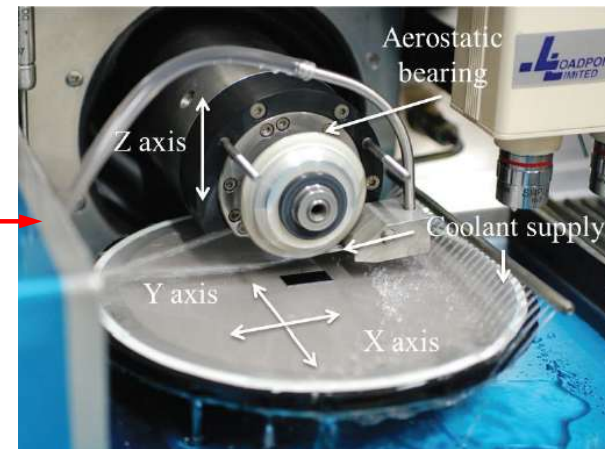
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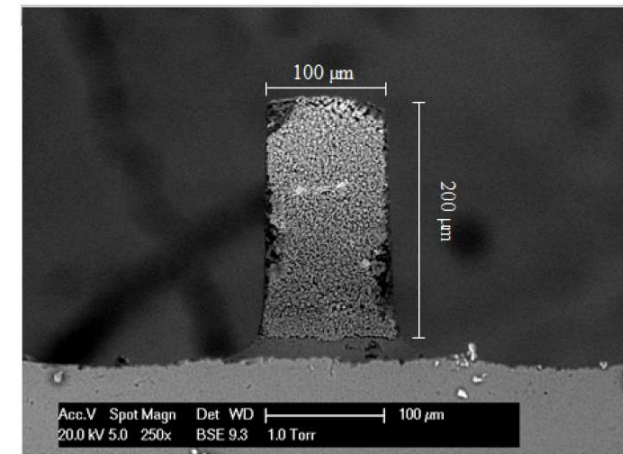
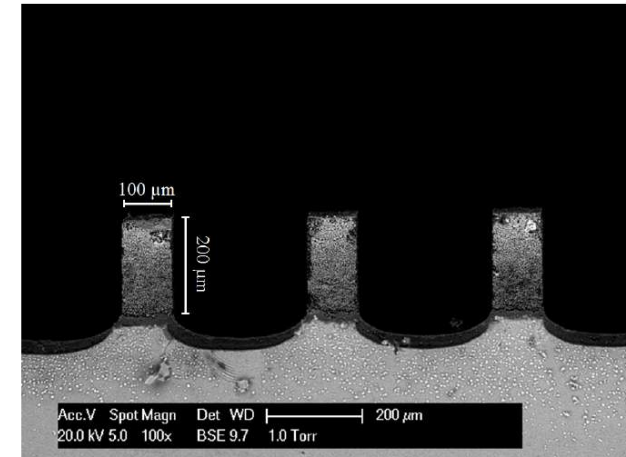
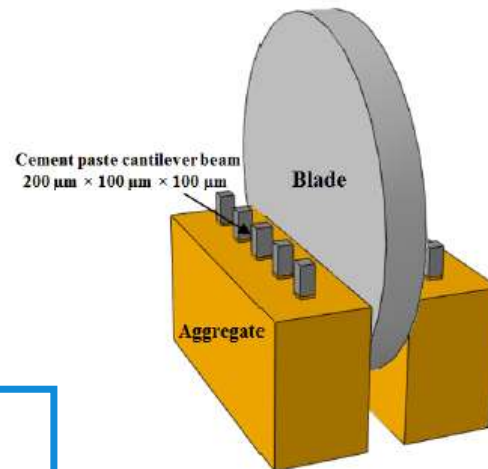
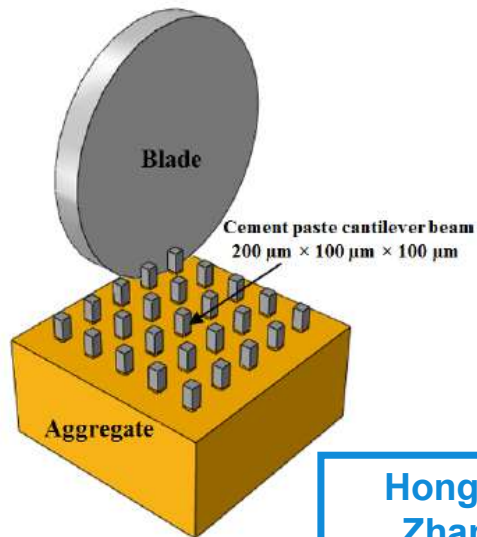
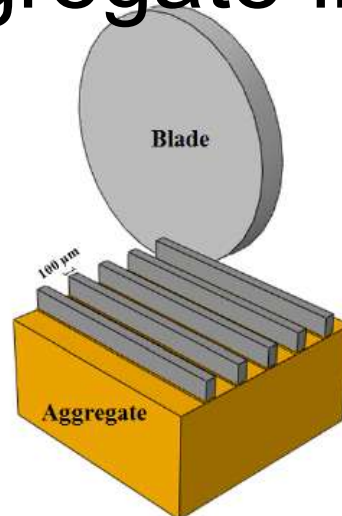
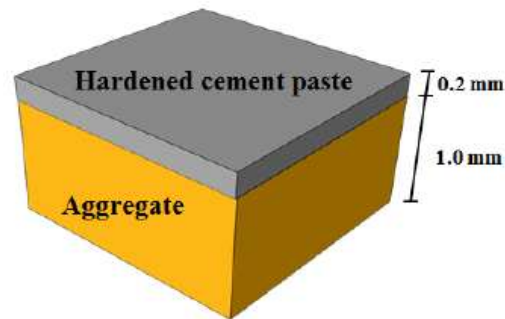
What about eigen-stresses?



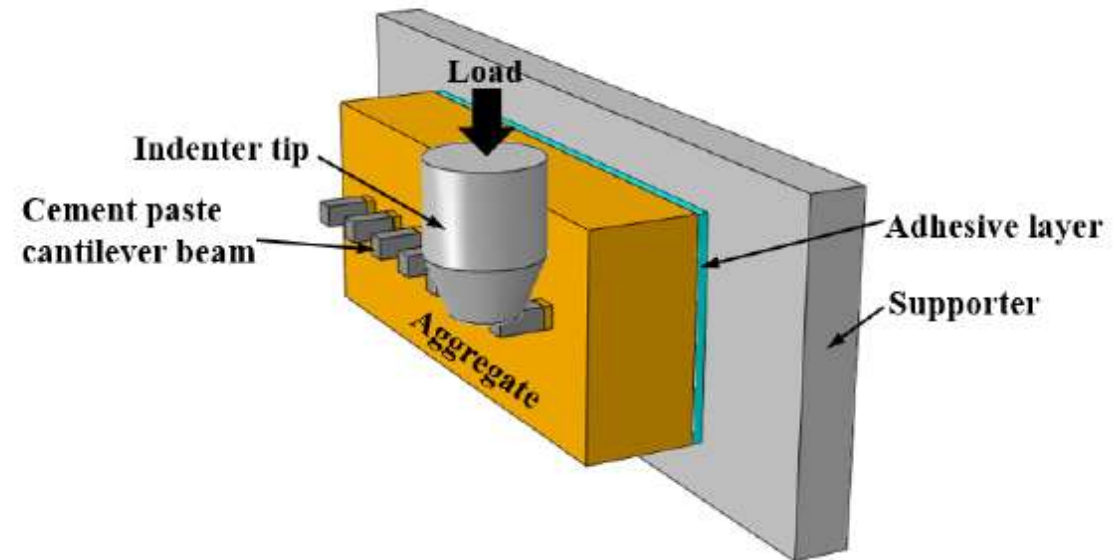
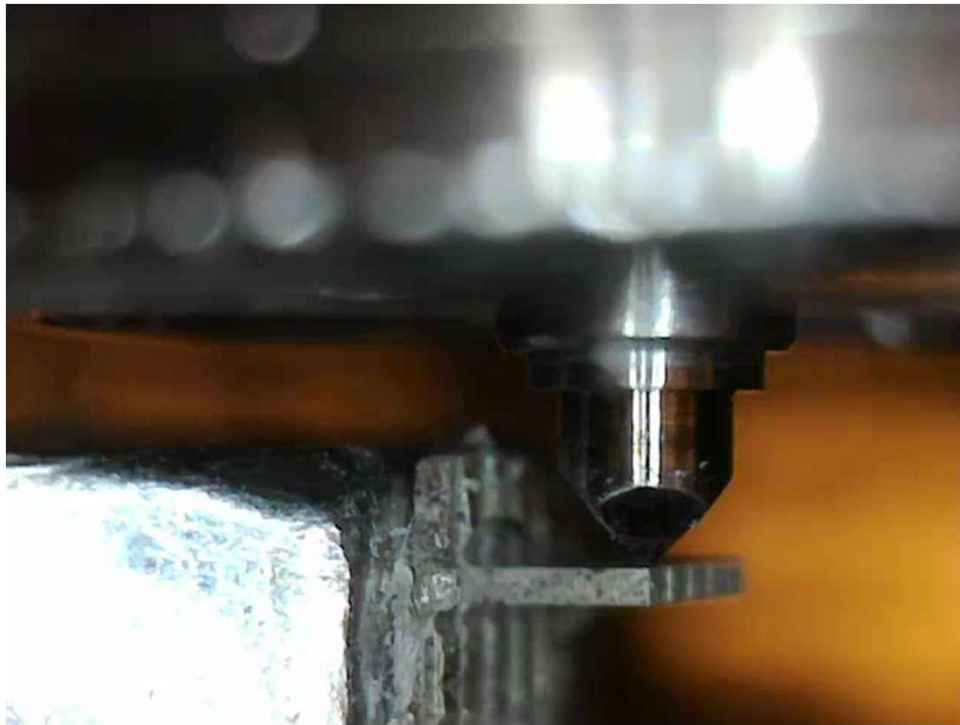
Silicon-wafer micro-dicing saw



Cement-paste aggregate interface

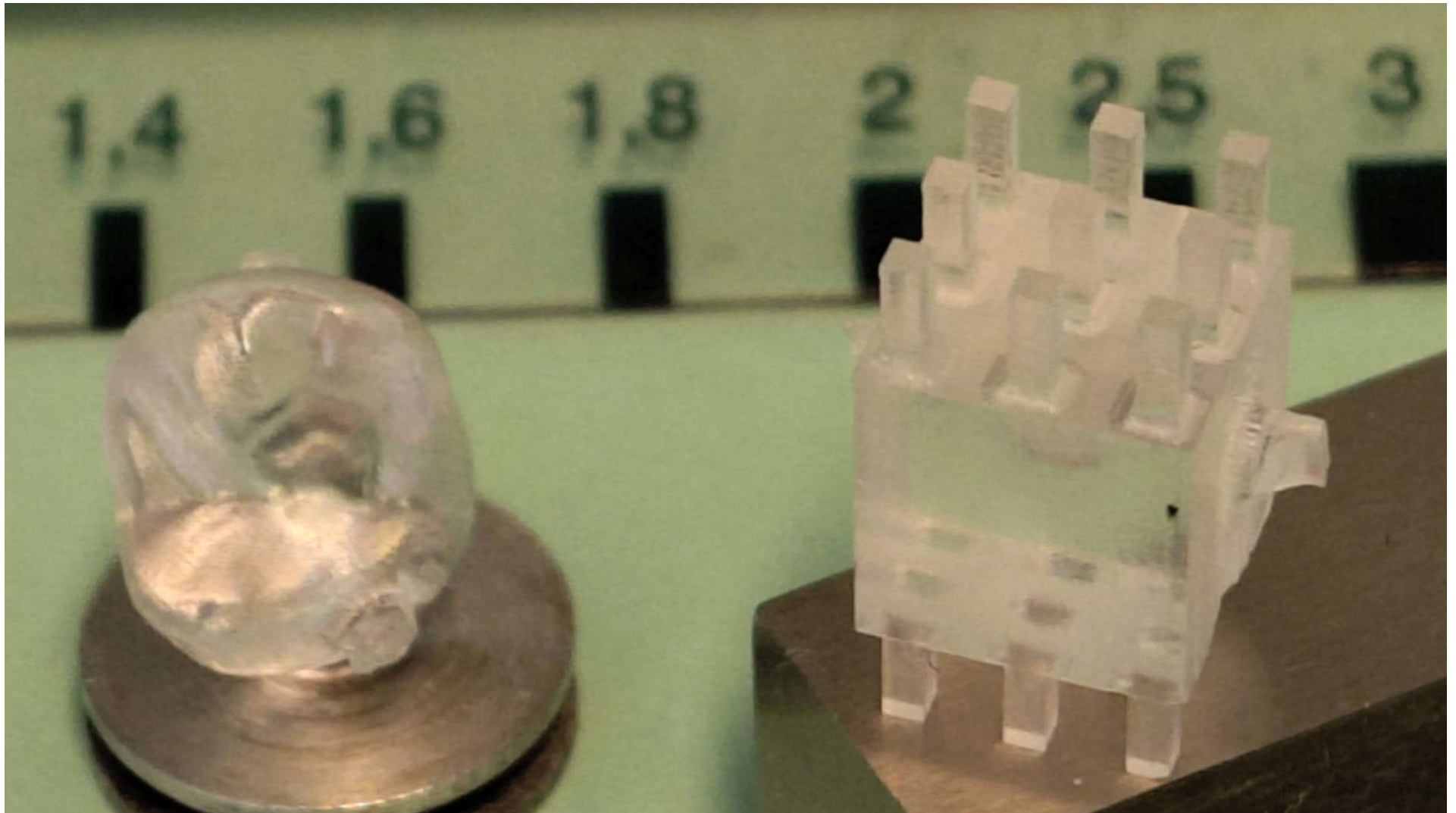


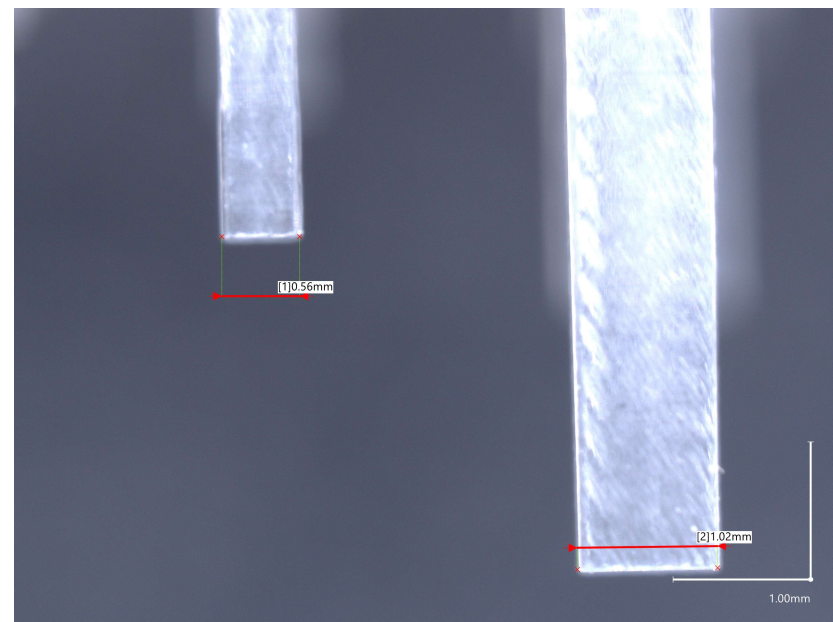
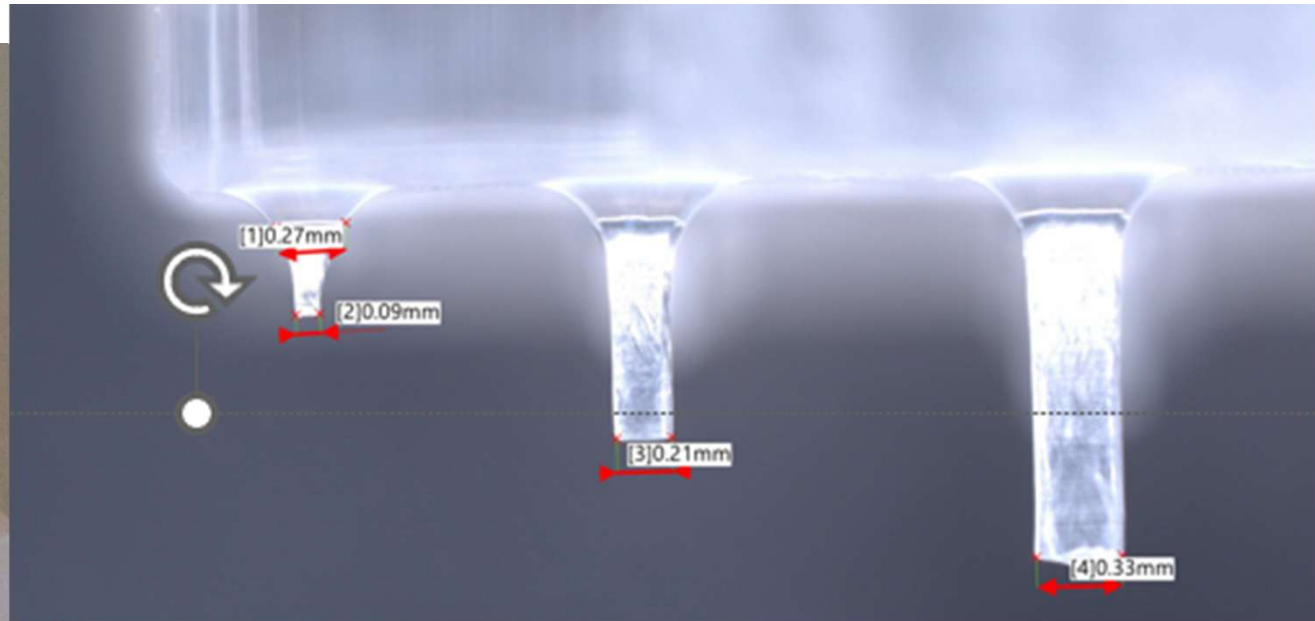
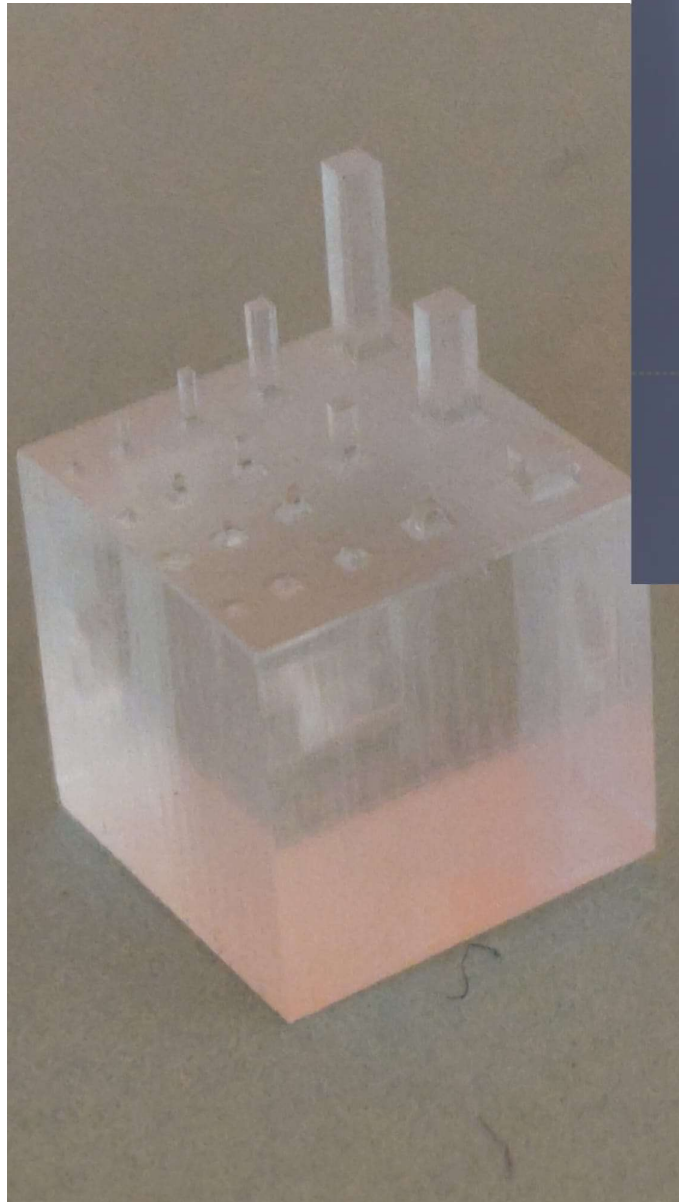
Cement-paste aggregate interface



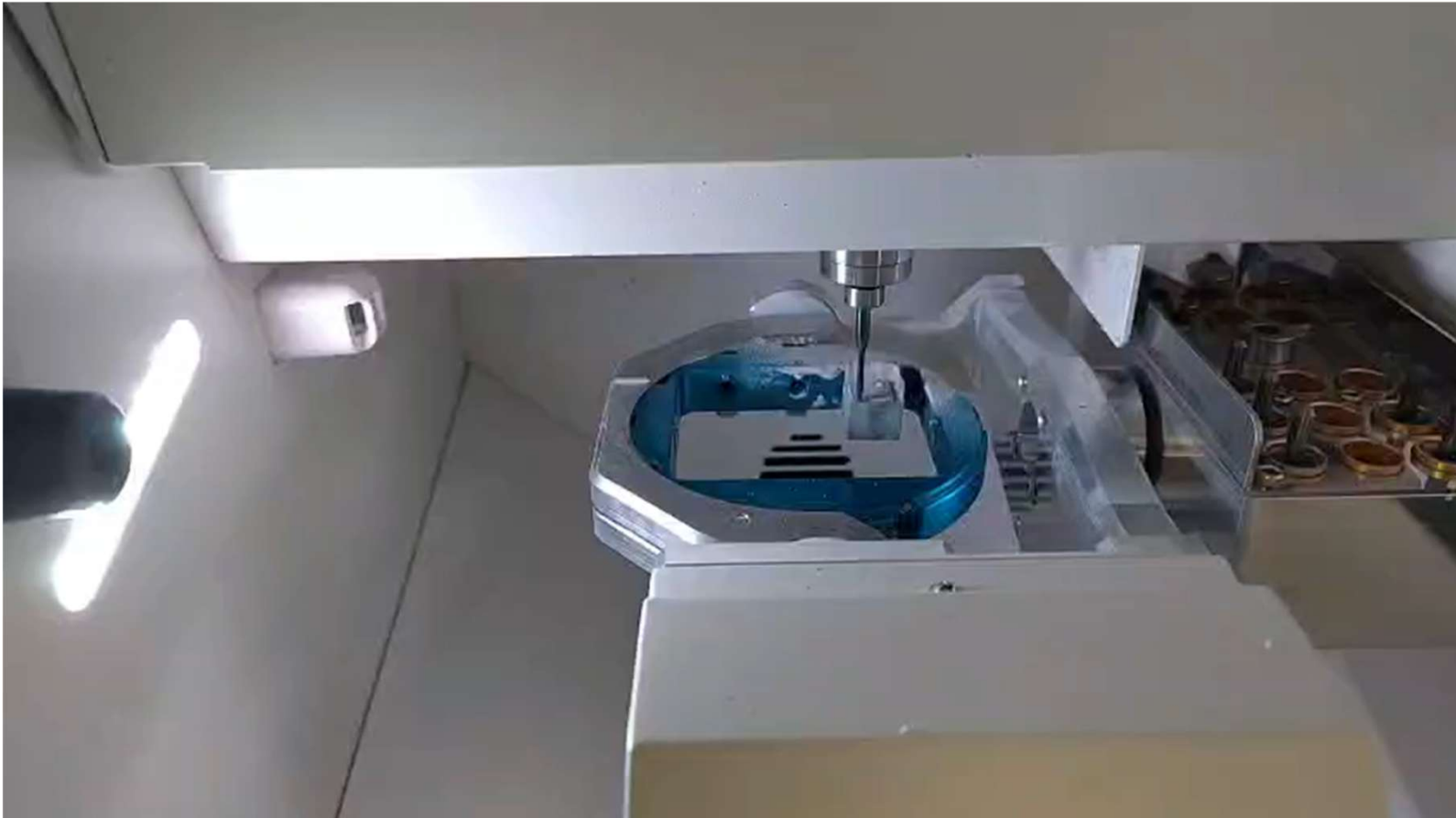
Dental milling machine

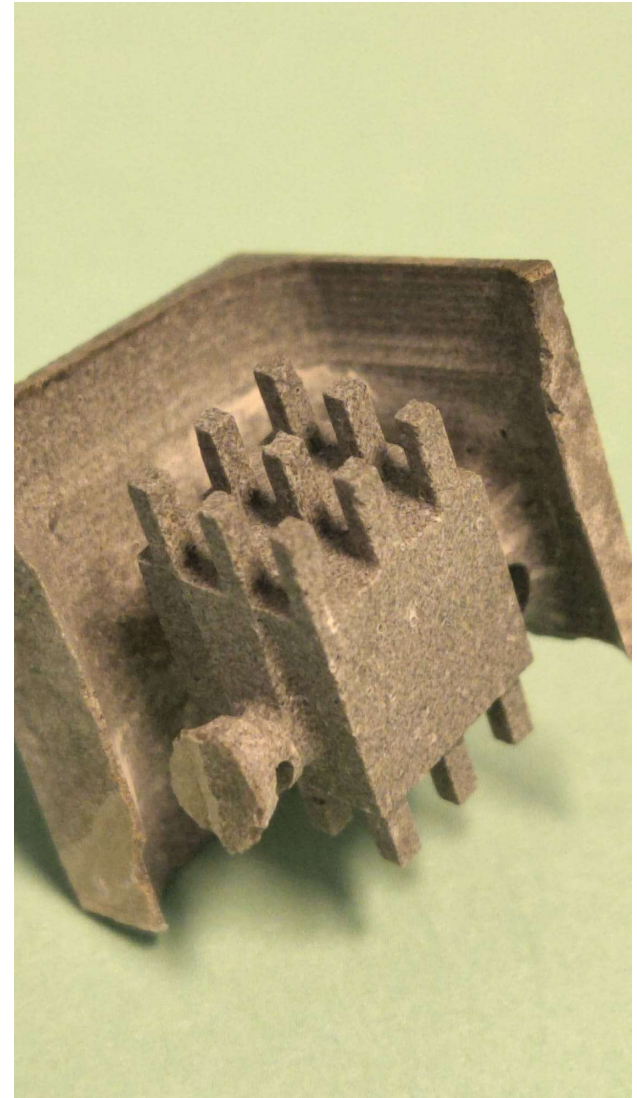
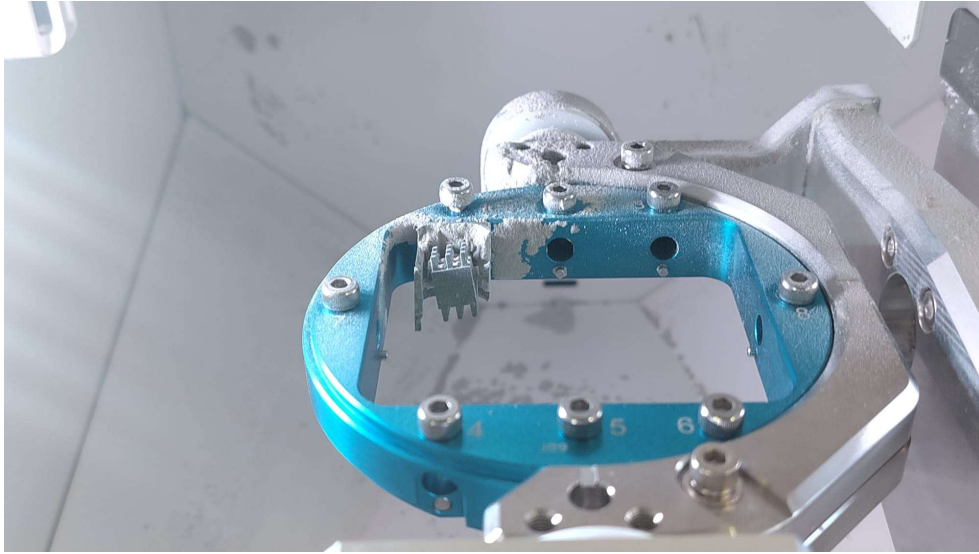




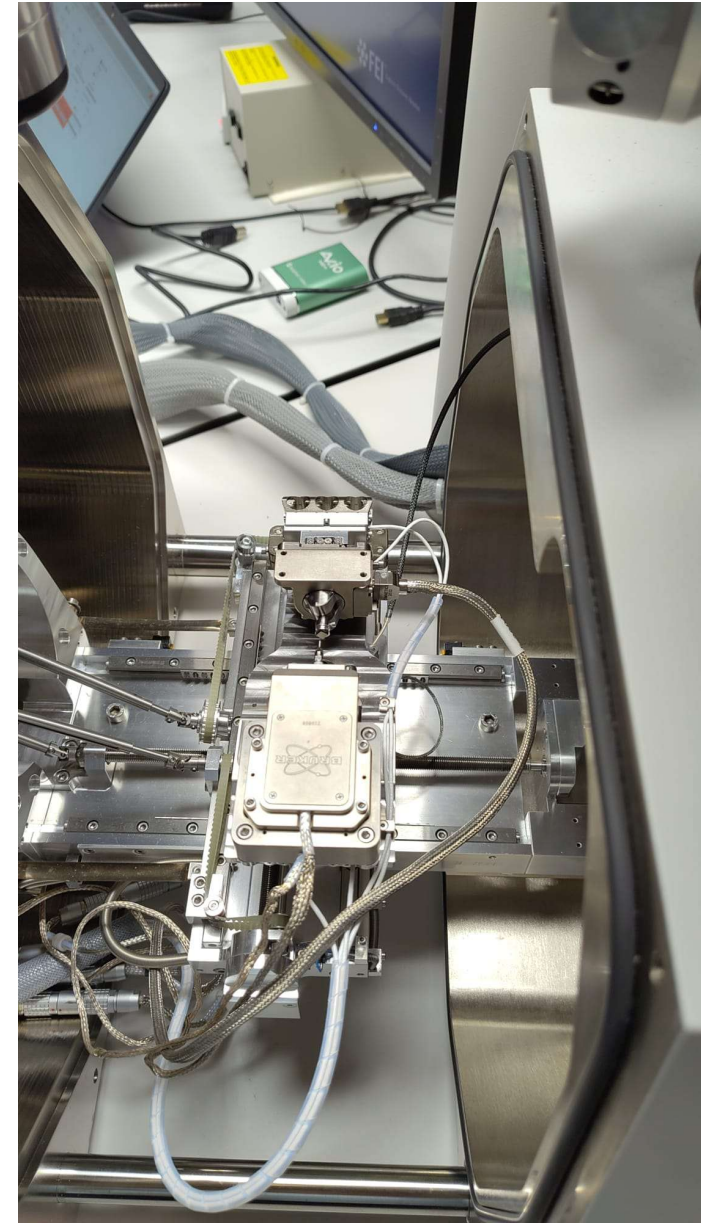
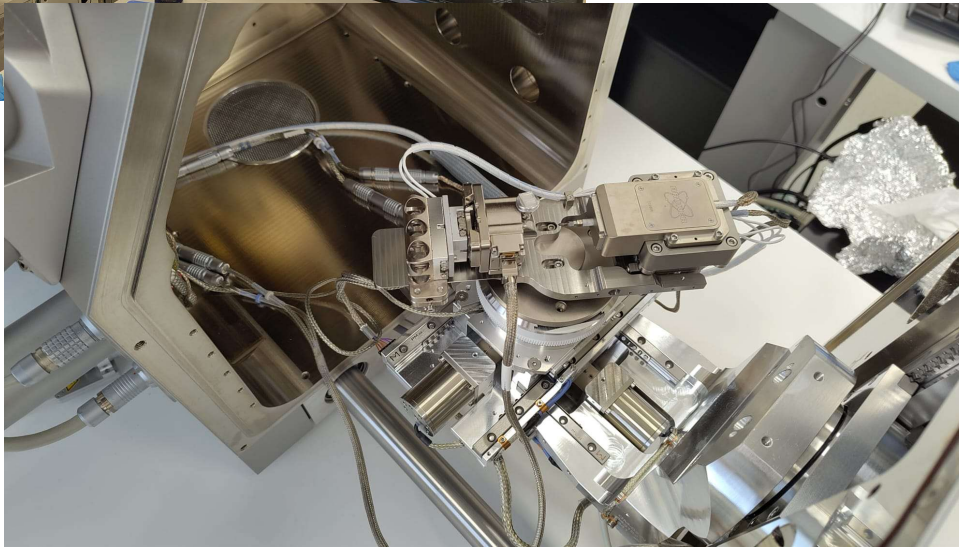
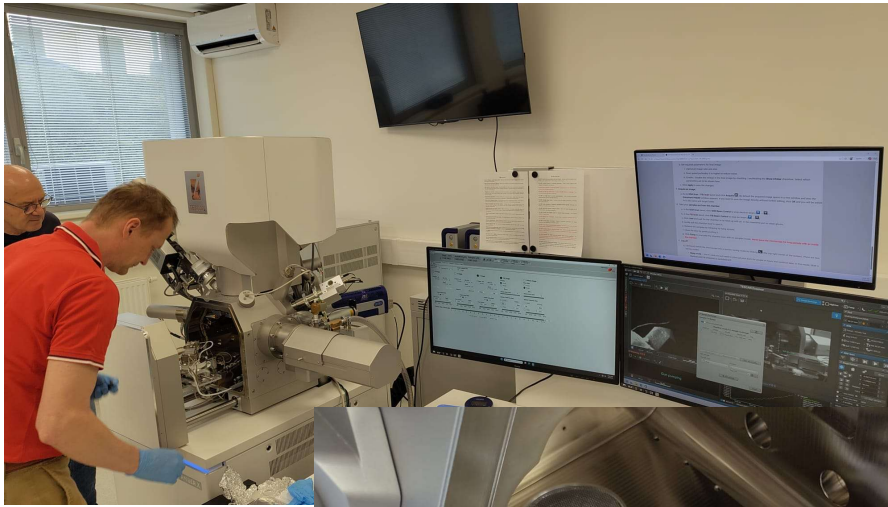


'Dental' (cement paste) Milling in action

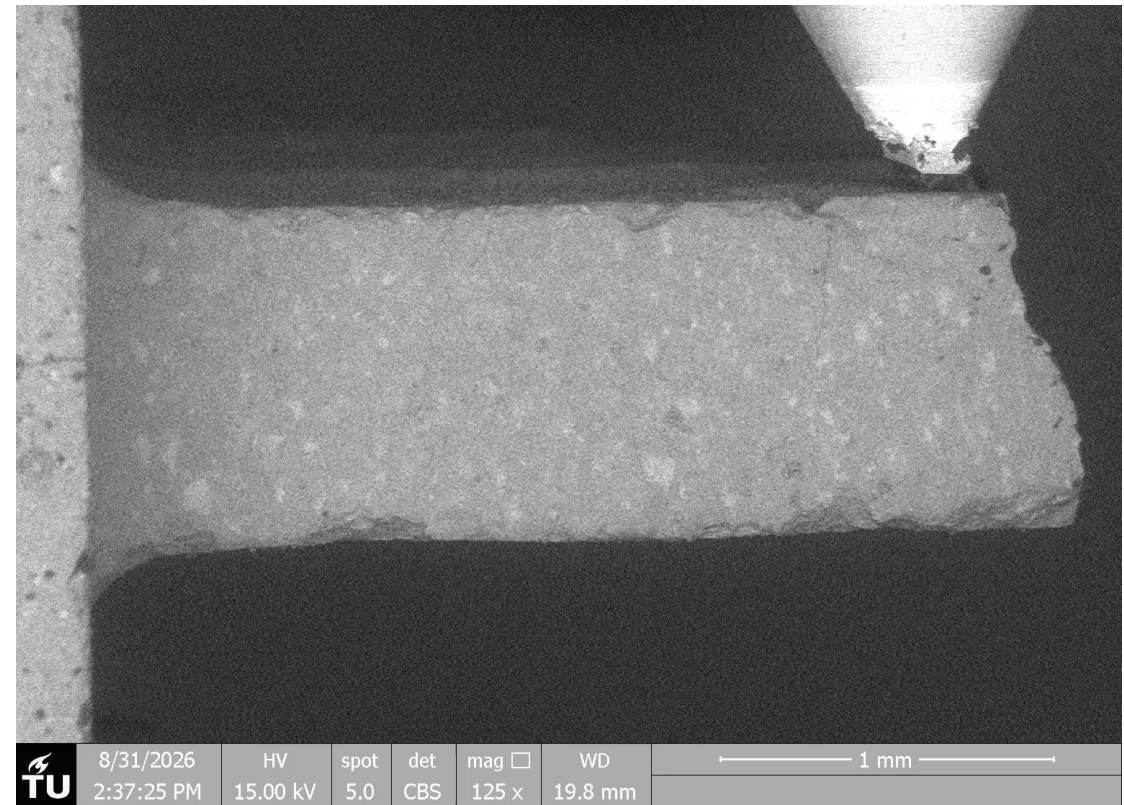
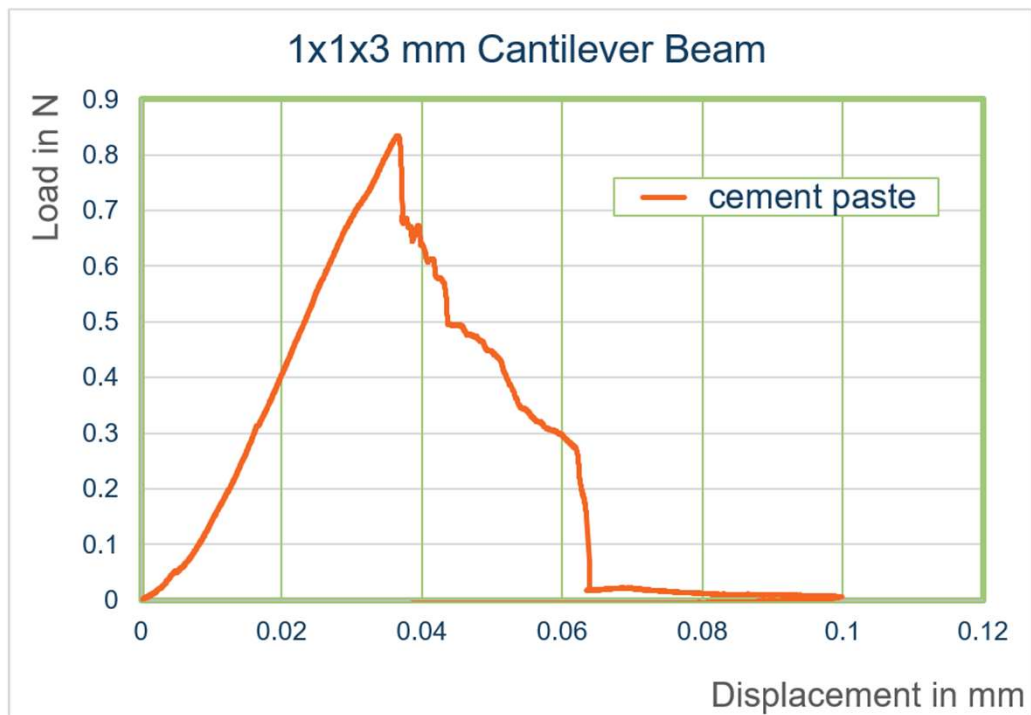




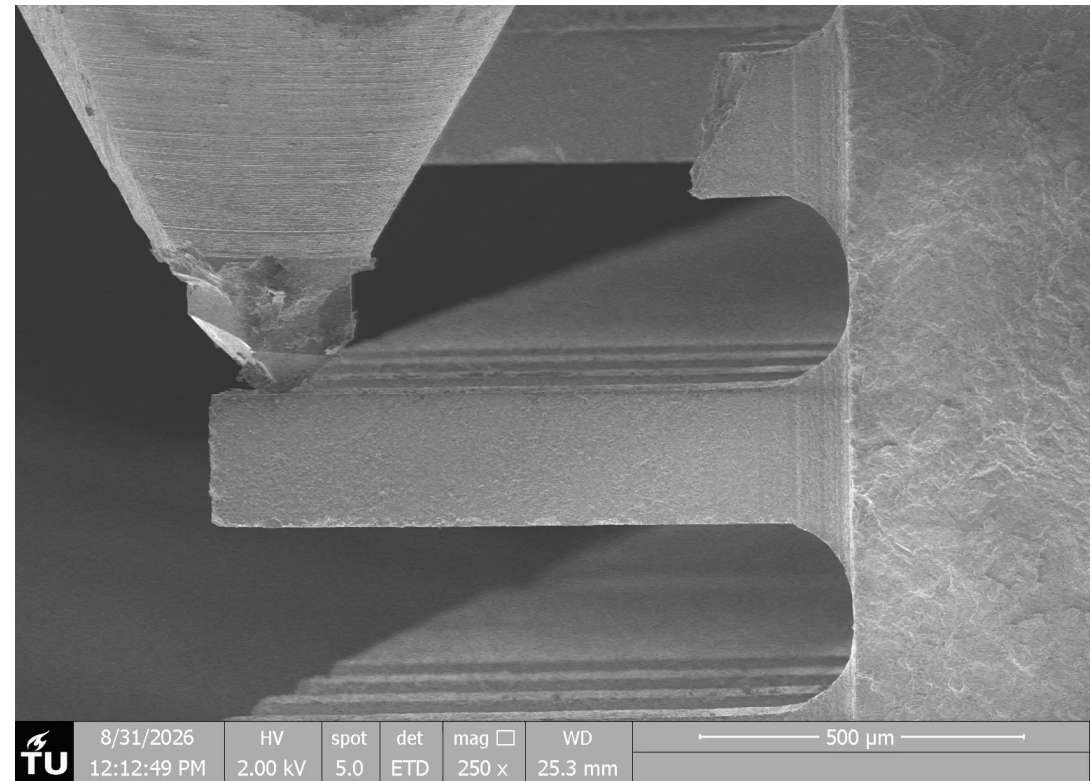
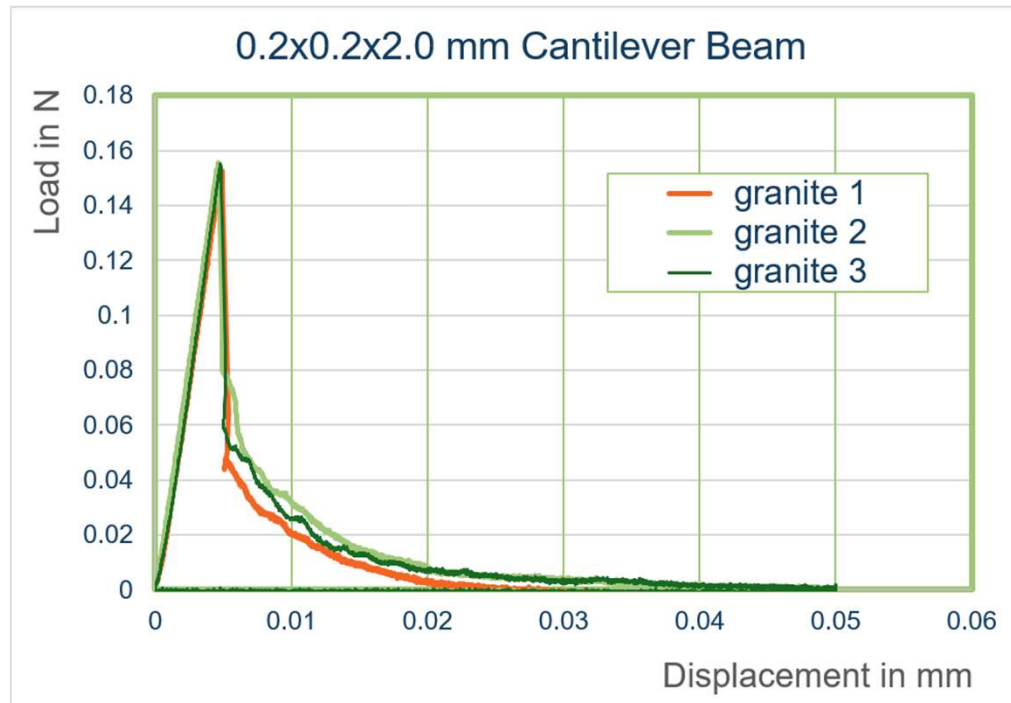
Bruker pico-indenter in (E)SEM



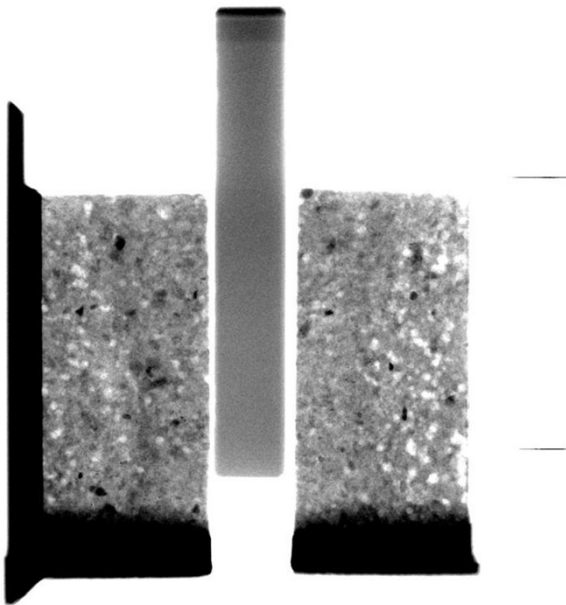
Cement paste Cantilever Beam



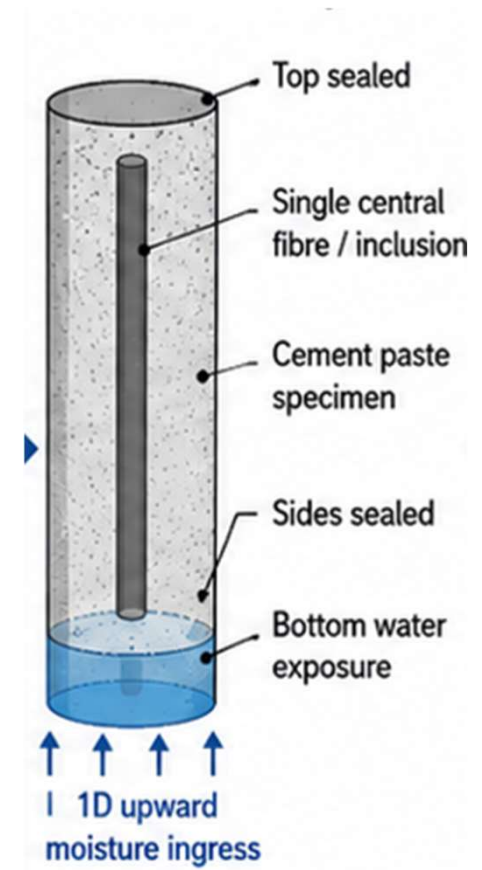
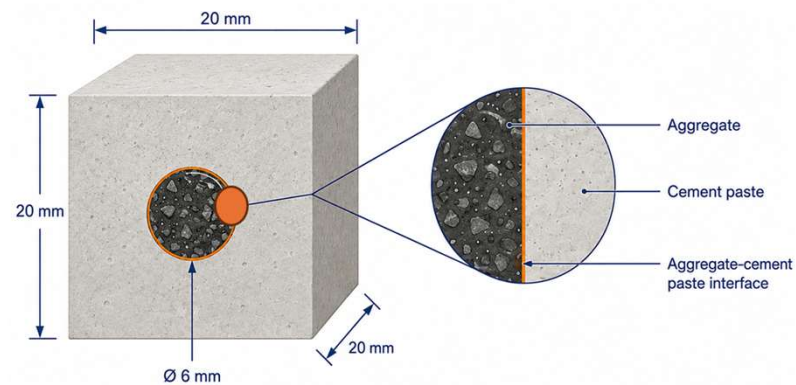
Granite cantilever beams



Moisture transport in CT-scanner



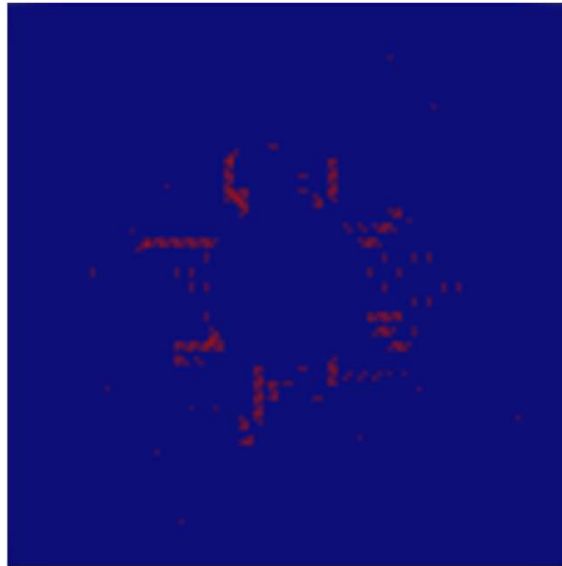
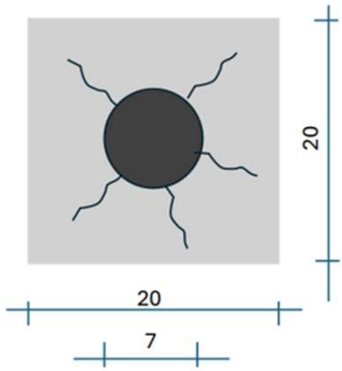
◇ Mladena Lukovic (PhD-thesis Delft)



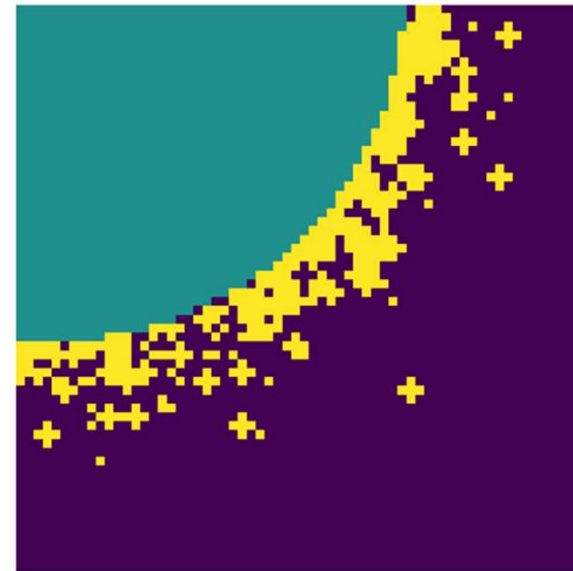
Modelling efforts



Fracture modelling



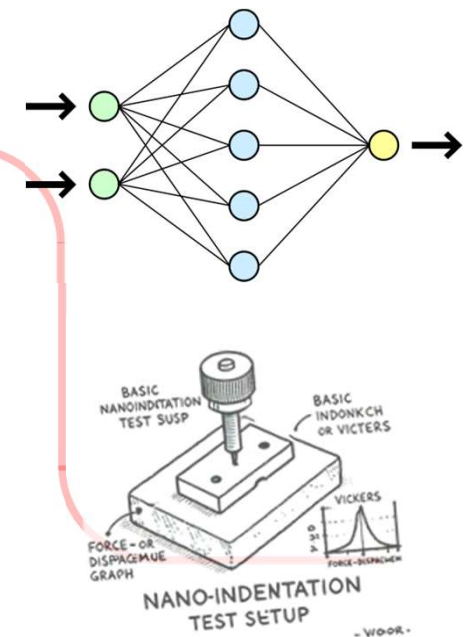
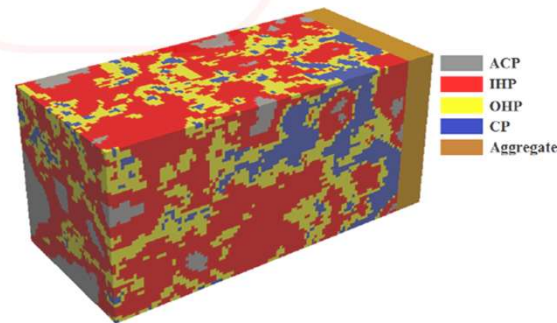
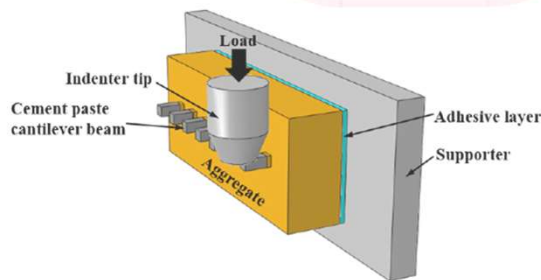
Microstructure generation



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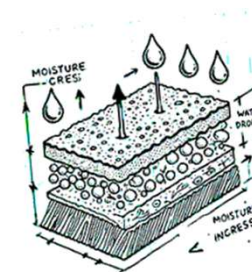
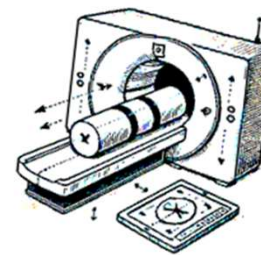
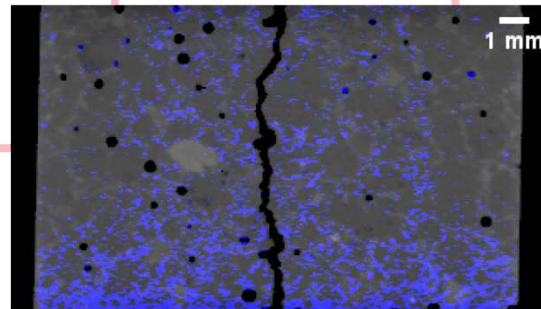
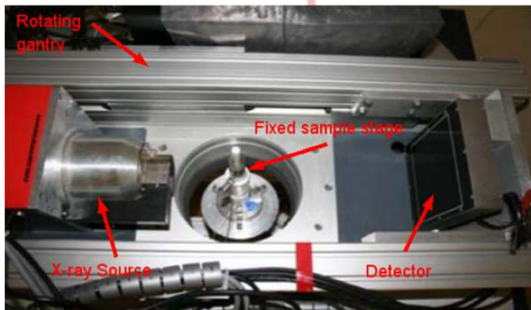
- ITZ micro-structure and
- Mechanical performance
- *Challenge*: measure eigen-stress
- Initial moisture tests
- AI for generation of ITZ-micro-structures

2027



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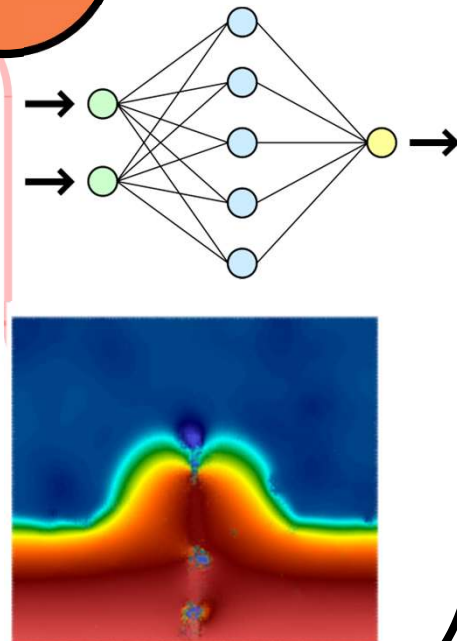
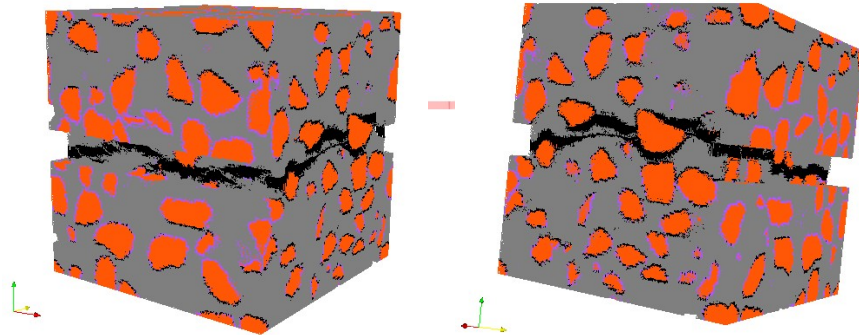
- *Challenge:* ITZ-transport measurements
- Research stay of PI and PhD at other facilities
- Measure changing eigenstresses due to transport



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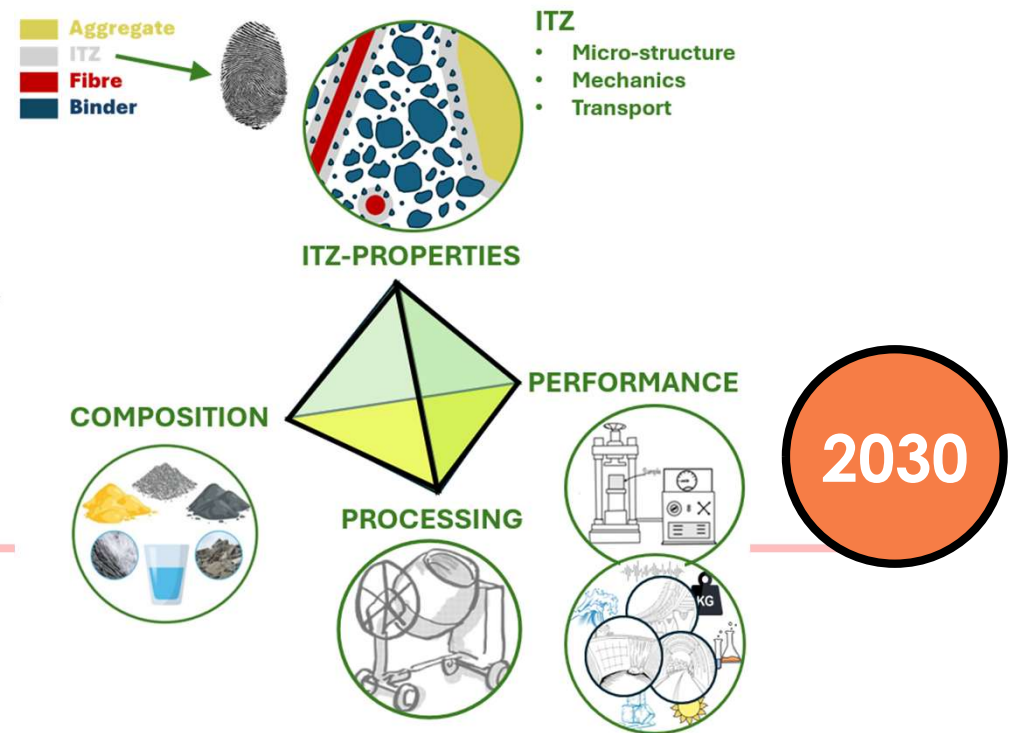
- *Challenge:* AI modelling
- Deterministic and probabilistic simulations
- ITZ - transport, durability and fracture processes

2029



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



Summary

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6. What are results?
7. Future....