

**i<sup>3</sup>Sense**  
**Intelligent, integrated and impregnated cellulose based sensors for reliable biobased structures**

Programme: COMET – Competence Centers for Excellent Technologies

Programme line: COMET-Module

Type of project: Module, 2022-2025, multi-firm

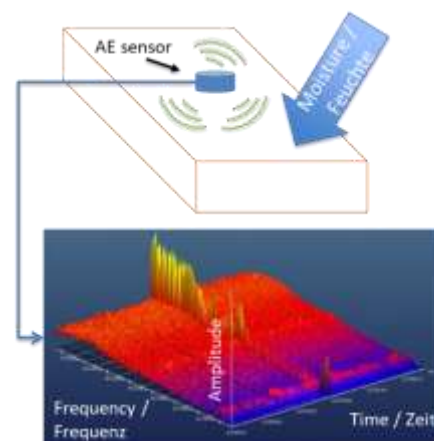


## SWELLING FORCES AS INDICATOR FOR MOISTURE UPTAKE OF WOOD

### CLOSE RELATIONSHIP BETWEEN ACOUSTIC EMISSIONS AND MOISTURE UPTAKE REVEAL POTENTIAL FOR MOISTURE MONITORING IN WOOD CONSTRUCTIONS

One of the major issues with wood as a building material is moisture absorption and the resulting consequences of dimensional instability, decreased strength or mold growth. Early detection of moisture uptake can result in a prompt solution, wherein areas with excessive moisture are handled locally or by replacing the affected elements.

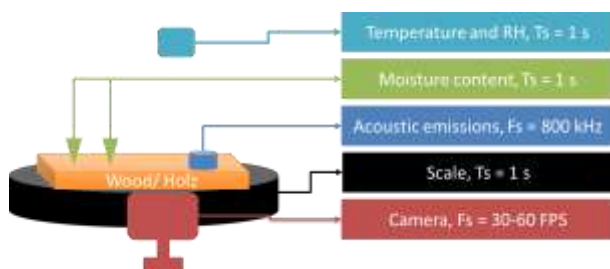
State of the art methods for measuring moisture content on site are usually too local or induce predetermined breaking points in wood composites. Hence, one of the aims of i<sup>3</sup>Sense is to empower wood itself to be used as a sensor for measuring water uptake.



Concept of measuring moisture uptake events with acoustic emissions. © Wood K plus

## SUCCESS STORY

In particular, a measurement system has currently been developed that includes an acoustic emissions sensor to monitor internal stress waves. As reference measurements for the moisture uptake of wood, a commercial moisture measurement device, a scale to monitor the weight increase and a camera to monitor the overall swelling of the cross section of the sample are used. Additionally, the relative humidity and the temperature are measured. The measurements are triggered simultaneously by using Python in combination with multiple modules such as OpenCV, pySerial and threading.



Experimental setup. © Wood K plus

The analysis of the acoustic emissions depends on event detection, whereby base noise and peaks are differentiated.

The pre-tests done so far have ranged from scenarios where a board is completely submerged under water, to a piece of dry wood was placed in a climate room. In all cases, it was seen that the occurrence of peaks in the acoustic energy is correlated with the increase of the cross-sectional area, which can be considered as an indicator of moisture uptake by the wood.

### Impact and effects

The mentioned measurement technique shows promising results as well as an easy and fast implementation. In addition, these measurements happen in real-time, which is important to enable the prompt reaction that is needed for avoiding irreversible damage.

### Project coordination (Story)

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- Metadynea Austria GmbH
- ETH Zurich
- Stora Enso Wood Products GmbH
- JKU Linz

This success story was provided by the consortium leader/center management and by the mentioned project partners for the purpose of being published on the FFG website. Further information on COMET: [www.ffg.at/comet](http://www.ffg.at/comet)