SPECIFICATIONS	
Operating frequency	13 MHz
Maximum measurement depth	20 mm
Best resolution	< 100 µm
Maximum sample size	No restriction

STANDARD SYSTEM COMPONENTS
NMR Spectrometer
Profile NMR-MOUSE sensor
High precision lift
Concrete analysis software

STANDARD WEIGHTS & DIMENSIONS	
Sensor weight	35 kg
Sensor dimensions	243 x 340 x120 mm
Lift weight	22 kg
Lift dimensions	373 x 343 x 350 mm
Spectrometer weight	5 kg
Spectrometer dimensions	360 x 260 x 160 mm

Contact us now to:

- ☑ Discuss your application
- ☑ Request a spectrum on your sample
- ☑ Request a quote
- ☑ Request a demonstration

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Nondestructive moisture profiling in concrete with a portable MRI sensor

ABSOLUTE MEASUREMENT:

The sensor measures the volumetric water content in concrete directly from the MR signal amplitude.

REMOTE AND NON-DESTRUCTIVE:

The measurement is performed without requiring any physical contact with the sample. Setting the sensor close to the object surface radiowaves are used to inspect the concrete material in a non-destructive way.

ANY SAMPLE SIZE:

Due to the open sensor design objects of arbitrary size can be accessed.

AUTOMATED DEPTH PROFILING:

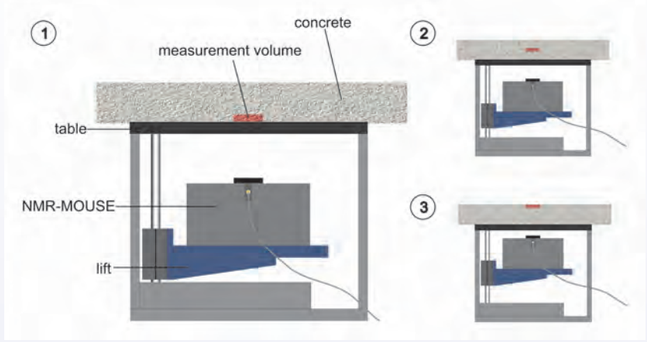
The sensor can profile the moisture content from 0 to 25 mm into the object. In this way drying and wetting processes can be effectively followed. The measurement of depth profiles is fully automated.

MEASUREMENT PROCEDURE

The sensor uses the same principles as clinical Magnetic Resonance Imaging. Water molecules are detected via radiofrequency waves and the amplitude of the response signal is a direct measure of the amount of water in the inspected volume.

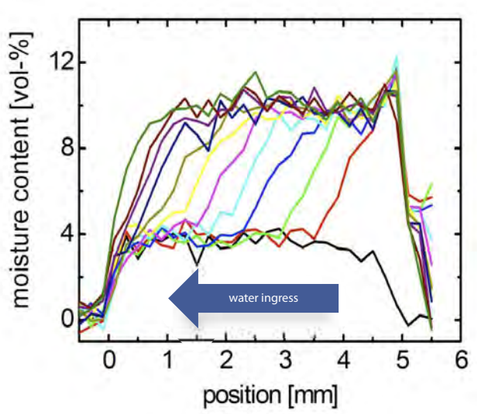
The measurement procedure requires placing the sensor next to the object surface or the sample on top of the sensor (depending on the size of the object). The high precision lift automatically moves the sensor to profile the water content as a function of the depth.

The figure shows the sensor starting at the lowest position (1) of the scanning range, when the sensitive volume is located at the surface of the sample. By moving the sensor upwards (2 and 3) the position of the sensitive volume is shifted to profile the water content as a function of the depth.

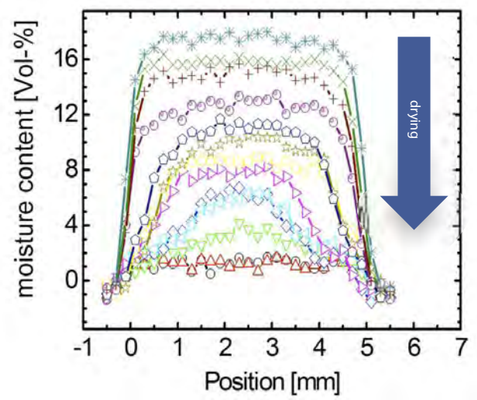


WATER TRANSPORT IN CONCRETE

The profile NMR-MOUSE can be used to follow the transport of water in dynamic processed like water uptake or drying of concrete samples. The example shows the ingress of water into a 5 mm thick concrete sample. Water was applied from one side on a dry concrete sample. With ongoing time it can be followed how the water penetrates into the sample. After 50 minutes the concrete sample is saturated indicated by a constant moisture content through out the sample.



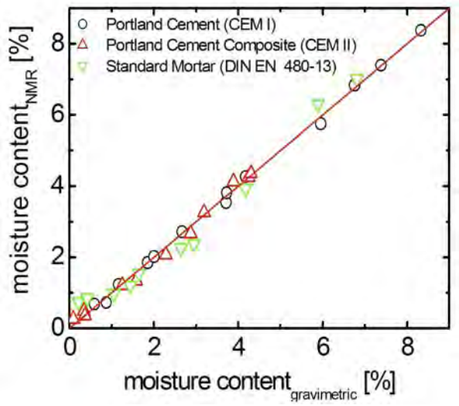
The figure at the bottom shows moisture profiles measured through a 5 mm thick concrete sample during a drying process. It can be observed how the amplitude of the uniform profile measured for the saturated sample decreases from the edges to the center until it equilibrates with the room humidity.



ABSOLUTE WATER CONTENT MEASUREMENT

The water content plays a crucial role during the production process and life time of building materials. Conventional methods available to measure water content are destructive and do not offer a way to spatially resolve the distribution of water in the sample. The profile NMR-MOUSE uses a technique, that is similar to the one used in clinical MRI machines. It offers the possibility to measure water content in a non-invasive way with high spatial resolution.

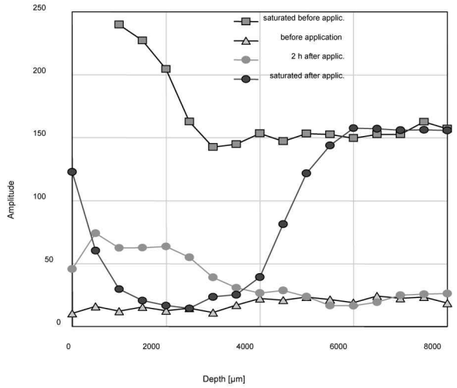
The figure shows the correlation between moisture content measured with the profile NMR-MOUSE and moisture content measured by weight. High linearity is observed for concrete materials prepared with different aggregates.



PENETRATION DEPTH OF WATER REPELLENT TREATMENTS

Water repellent treatments on facades are used to prevent moisture absorbance of mineral building materials. Conventionally the treatment is applied by impregnating the facade with a hydrophobic agent. Decisive for the performance of the treatment is the penetration depth of the hydrophobic agent. Conventionally the penetration depth is measured destructively by extracting a bore core from the facade and visually inspecting the presence of the hydrophobic agent.

The profile NMR-MOUSE allows to measure nondestructively the spatial distribution of the agent inside the facade. The figure shows profiles before and after application and water saturating of a concrete sample. The penetration depth of the hydrophobic agent can be clearly observed as well as its impact on the water saturation.



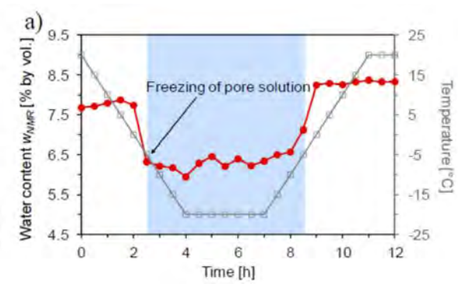
Courtesy of Udo Antons, Institute of building material Research (IBAC), RWTH Aachen University

MEASUREMENTS DURING FREEZE-THAW CYCLES

Damage of concrete structures exposed to a combined freeze-thaw deicing salt attack is one of the major deterioration mechanisms in cold climates. Before damage occurs, concrete structures subjected to freeze-thaw cycles in the presence of water or deicing salt solution exhibit fast moisture uptake known as frost suction.

The PM25 can be used to follow the water content during freeze thaw cycles and can help to identify the amount of physically bound water and water located in capillary and meso pores.

Figure a) shows the total amount of liquid water during a freeze thaw cycle while Figure b) shows the fraction of physically bound and pore water.



Courtesy of Charlotte Milachowski, Centre for building materials, Technische Universitä'8at Mü'9fnchen