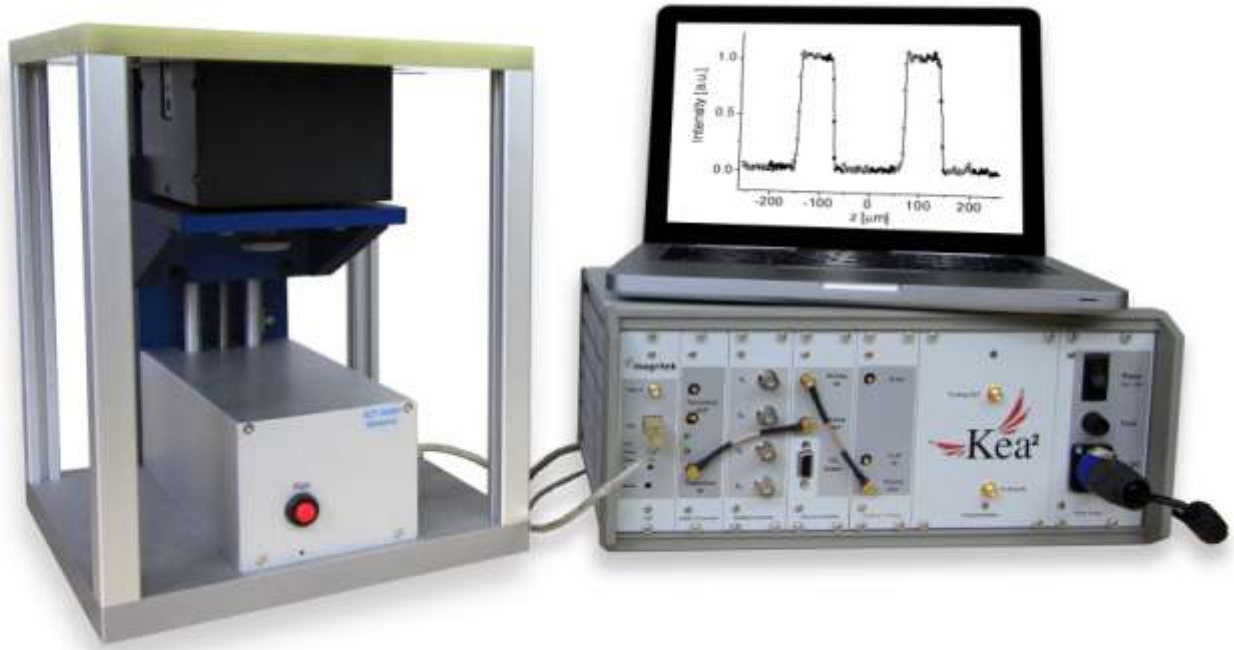
profile NMR-MOUSE

Profiling large samples with microscopic resolution



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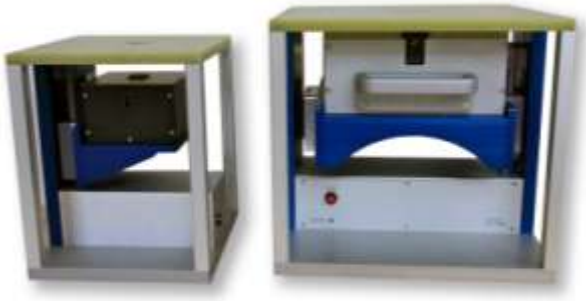
- Micrometer resolution
- Open access
- Portable
- High performance spectrometer
- Fully automated
- Small footprint
- Optional as 3D imaging system

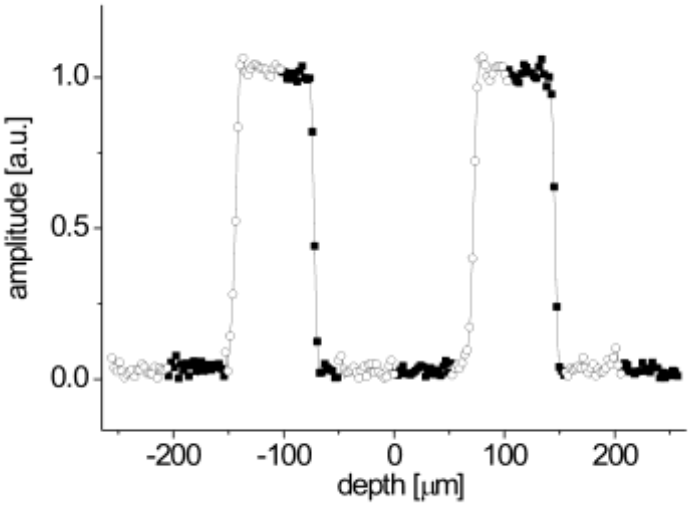
The *profile* NMR-MOUSE is a portable open NMR sensor equipped with a novel permanent magnet geometry that generates a highly uniform gradient perpendicular to the scanner surface. Given this field profile, a flat sensitive volume is excited and detected by a surface rf coil placed on top of the magnet at a position that defines the maximum penetration depth into the sample. By repositioning the sensitive slice across the object, this scanner produces one-dimensional profiles of the sample structure with a spatial resolution better than 5 µm. Moreover, flat gradient coils can be mounted between the magnet and the rf coil to achieve lateral resolution across the sensitive slice. The *profile* NMR-MOUSE can be provided as a complete system with a high precision lift and the state-of-the-art mobile spectrometer Kea2 by Magritek.



profile NMR-MOUSE models PM 5 and PM 25 mounted in high precision lifts.

Model	Max. depth [mm]	Resolution [µm]
PM 2	2	5
PM 5	5	10
PM 10	10	30
PM 25	25	100

Available models customized for your application.



High resolution profiles through an oil-glass multi-layer structure.

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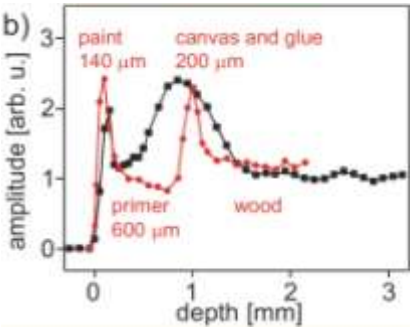
Non-destructive characterization of paintings

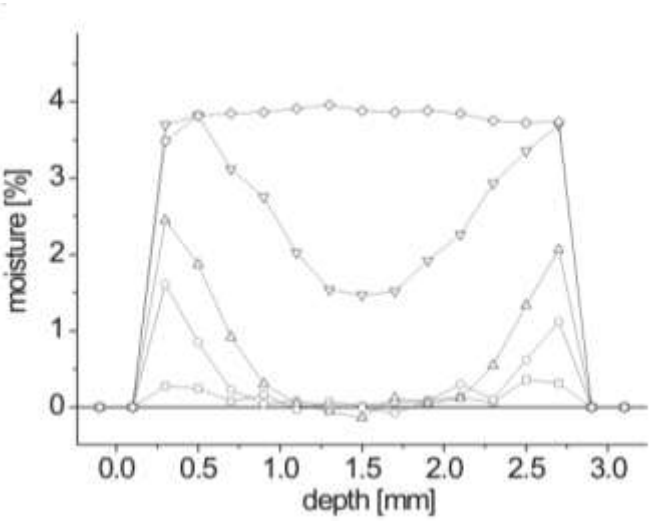
The conservation of cultural heritage is a particular field where the use of non-destructive characterization methods is mandatory considering the uniqueness of the object under study. The profile NMR MOUSE provides the unique possibility to study painting structures, layer thicknesses, type of binder, aging processes etc. The example shows profiles taken at different positions of a painting. The thickness of each layer can be determined and changes of the preparation at different positions can be revealed. Such a detailed information can have great value in assessing the state of conservation of the paintings including the support structure.



Profiles of paintings where different layers can clearly be resolved.

Moisture detection in polymers

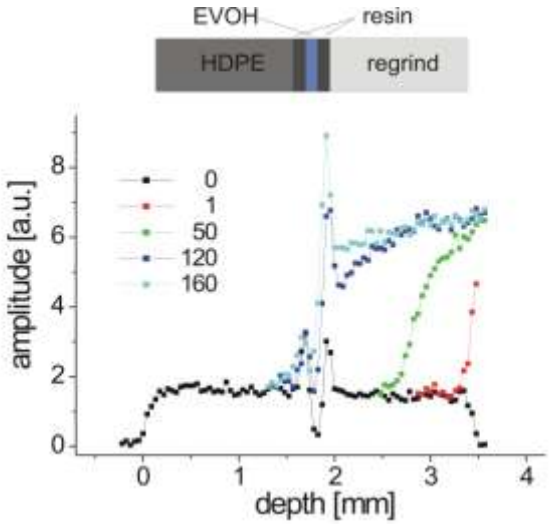
An important example of sample change is the ingress of liquids in contact with the object surface. Already small amounts of solvent may invoke major changes in material properties that can be detected by mobile unilateral NMR sensors. The example shows the water uptake in a polymer composite as a function of the absorption time. A 3 mm thick sample was initially dried in an oven and then immersed in water at room temperature. A series of profiles was measured as a function of the time of exposure to water. The profiles were obtained by scanning the sample with a resolution of 200 µm and assigning to each position the amplitude resultant from the addition of the echoes acquired during a solid-echo train. The results show that the technique can be used to follow the penetration front of solvents into hard materials. Further experiments showed, that the sensitivity of the technique is high enough even to detect the moisture of the sample due to the ambient humidity.



Profiles showing the ingress of water in a 3 mm thick PE sample as function of time

Solvent ingress into polymers

Dynamic transport processes happening at the material surface, like the ingress of solvents into solid materials, play a major role in many cases. An example of such a material is fuel tank wall, which consist of a multi-layer structure composed of two PE layers separated by a barrier of ethylene vinyl alcohol copolymer (EVOH) used to block the diffusion of volatile compounds through the tank wall. This layer is glued to the two polyethylene plates by means of two thin resin layers. The figure shows a profile measured through the tank wall with a resolution of 50 µm. The different layers can clearly be identified. To prove the efficiency of the barrier layer, the diffusion of the gasoline inside the tank wall was followed after exposing the regrind side of the tank to gasoline (RON 91) by measuring profiles of the tank wall. The profiles show the diffusion front moving into the PE layer and stopping at the barrier. After 160 h a gasoline saturation of the regrind is reached, while the barrier layer keeps the other side almost unaffected.



Profiles showing the structure of a gasoline tank wall, and the ingress of gasoline for different exposure times.

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