LABORATORY: CNR ISPC

NAME OF THE INSTRUMENT

Portable Nuclear Magnetic Resonance (NMR-MOUSE)

GENERAL DESCRIPTION:

Portable Nuclear Magnetic Resonance (NMR-MOUSE) is an instrument available at MOLAB to perform in situ analysis on mural paintings, easel paintings, wood and cellulose based manufacts, polymers, and lapideous materials.

The analysis can be performed from the surface up to 1 cm in depth in a non-invasive way. The main applications are:

- Measuring water content and moisture (2D mapping).
- Studying the stratigraphy in paintings and composite objects by applying a micrometrical resolution to measure thickness layers and to evaluate detachments and micro-fractures.
- Evaluating consolidating, protective and cleaning products
- Measuring open porosity, tortuosity, and porosity distribution in porous materials.
- Evaluating and mapping the degree of degradation and physical-chemical properties.
- Measuring diffusion and transport of solvents in paintings, gels and porous materials.

TECHNICAL INFORMATION:

NMR-MOUSE (also called unilateral NMR) is equipped with two probe head:

1. A probe from Bruker Biospin, operating in the range of 16-18 MHz (^{1}H) to perform measurements at fixed depths of 1, 3, e 5 mm from the surface.
2. A probe operating at 13.6 MHz developed by RWTH Aachen University, to analyze depth profiles, relaxation times, and diffusion measurements. Maximum depth of scanning 10 millimeters from the surface, with a selective micrometrical resolution of 20 micrometers.

Figure: NMR probe mounted on its metal arm and support while measuring paintings.

FURTHER INFORMATION:

- D. Capitani, V. Di Tullio, N. Proietti, Nuclear magnetic resonance to characterize and monitor cultural heritage, Progress in nuclear Magnetic resonance Spectroscopy 64, 29-69, 2012.
- V. Di Tullio, G. Sciutto, N. Proietti, S. Prati, R. Mazzeo, C. Colombo, E. Cantisani, V. Romè, D.Rigaglia, D.Capitani, ^{1}H NMR depth profiles combined with portable and micro- analytical techniques for evaluating cleaning methods and identifying original, non-original, and degraded materials of a 16th century Italian wall painting, Microchemical Journal 141, 40-50, 2018.

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