

# MEE

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## TECHNICAL FOCUS

### Moisture Detection Techniques

**San Rocco  
Church**

**Protection of  
Cultural Heritage**

**Testing of  
Complex Moisture  
Regimes**

**Sub-surface  
Investigations**

**Infrared  
Thermography**

**Gravimetric  
Techniques**

**Testing  
Moisture  
Content**

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**TECHNICAL FOCUS ISSUE:  
MOISTURE DETECTION TECHNIQUES**

**FEATURES**

- 32 San Rocco**  
San Rocco Church: A Typical Ancient Structure in Northern Italy  
E. Rosina and A. Sansonetti
- 41 Moisture Damage**  
New Tools for the Protection of Cultural Heritage in Italy: Innovative Techniques for In-situ Diagnostics  
Antonio Sansonetti, Elisabetta Rosina and Nicola Ludwig
- 48 Climate Change**  
Climate Change and the Testing of Complex Moisture Regimes in Building Stone: Preliminary Observations on Possible Strategies  
B. J. Smith, S. Srinivasan, S. McCabe, D. McAllister, N. M. Cutler, P. A. M. Basheer and H. A. Viles



**TECHNICAL PAPERS**

- 89 Innovative Techniques for Sub-surface Investigations**  
R. Olmi, S. Priori, D. Capitani, N. Proietti, L. Capineri, P. Falorni, R. Negrotti and C. Riminesi
- 97 Infrared Thermography for Moisture Detection: A Laboratory Study and In-situ Test**  
Ermanno Grinzato, Nicola Ludwig, Gianluca Cadelano, Michele Bertucci, Marco Gargano and Paolo Bison
- 105 Moisture Measurement in Masonry Using Gravimetric Techniques**  
Umberto Casellato, Massimo Valentini and Luigi Soroldoni  
UMBERTO CASELLATO, MASSIMO VALENTINI AND LUIGI SOROLDONI
- 111 Limits and Advantages of Different Techniques for Testing Moisture Content in Masonry**  
P. Bison, G. Cadelano, L. Capineri, D. Capitani, U. Casellato, P. Faroldi, E. Grinzato, N. Ludwig, R. Olmi, S. Priori, N. Proietti, E. Rosina, R. Ruggeri, A. Sansonetti, L. Soroldoni and M. Valentini



## Moisture Detection

**THIS ISSUE OF MATERIALS EVALUATION** focuses on innovative techniques used to measure different parameters related to water content in masonry. The features and technical papers utilize and compare data that was collected from a small ancient church, the San Rocco Church, located in northern Italy.

The results of these studies are part of the Moisture Detection in Historical Masonry (MODihMA) research project that involves experts from many Italian research laboratories. The first objective of this project was to compare the effectiveness of the different techniques to understand how the quantitative data obtained are directly related to water content. The second objective of the MODihMA project was to compare the ability of the different techniques to map water as a function of location and depth within the masonry structure, both on a macro- and micro-scale.

The issue begins with a feature paper that presents the project, as well as the building under study (San Rocco Church). The next two papers are also features, and describe critical issues of humidity, as well as introduce new research perspectives.

Following the feature papers, this issue includes four technical papers, with the final technical paper showing a comparison of all the previously mentioned techniques. The first technical paper, "Innovative Techniques for Sub-surface Investigations," reports the measurement of moisture content at 80 to 150 mm beneath the masonry surface using the fixed points technique, and compares these measurements with the results obtained from established techniques.

The second technical paper, "Infrared Thermography for Moisture Detection: A Laboratory Study and In-situ Test," starts from a new perspective. The established techniques are used to record how water content measurement is affected by environmental factors and hygroscopicity of the materials employed.

The third paper, "Measurements of Moisture in Masonry by Gravimetric Techniques," summarizes the results of measuring evaporative flux using infrared thermography, and focusing on the exterior layer of the surface and its aptitude for exchanging water vapor with the environment.

The fourth paper, "Limits and Advantages of Different Techniques for Testing Moisture Content in Masonry," summarizes the measurements of water content at 0 to 50 mm beneath the surface obtained with several new techniques: holographic radar, evanescent field dielectrometry and nuclear magnetic resonance. The results were compared to those obtained with established techniques for detection of moisture, measurement of porosity and mapping of salt distribution. This final paper presents an overall discussion of the results and an evaluation of the techniques according to measured parameters and values, the accuracy and reliability of the results, feasibility, the required environmental conditions for optimal performance, the time needed for measurements and associated costs.

This Technical Focus issue of *Materials Evaluation* is the result of a collaboration between three national research institutes: the National Research Council, the State University of Milan and Politecnico di Milano. Nicola Ludwig and Antonio Sansonetti actively collaborated as co-editors for this issue and as a scientific board (together with Vasco Fassina [the National Research Council] and Bernard Smith [Queen's University, Belfast, Northern Ireland]) to evaluate the results of the research, as well as the papers presented in this issue. Several research laboratories also supported the experimental tests used for these studies. They include: Experimental Laboratory, BEST Dept., Politecnico di Milano, Milan, Italy; Fi. T. Be. C. Laboratory, Energy Dept., Politecnico di Milano, Milan, Italy; IFGA, Università degli studi di Milano, Milan, Italy; Ultrasound and Non Destructive Testing Laboratory, Electronics and Telecommunications Dept., Università degli studi di Firenze, Florence, Italy; CNR, ICVBC area, Milan and Florence, Italy; CNR, ICIS area, Padua, Italy; CNR, ITC area, Padua, Italy; CNR, ITABC area, Rome, Italy; CNR, IMC area, Rome, Italy; CNR, IFAC area, Sesto fiorentino, Florence, Italy; and Accademia del restauro Galli, Como, Italy.

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