

IN SITU ACOUSTIC IMAGING TO REVEAL GLAZE DELAMINATIONS, IN THE EARLY STAGES, IN PORTUGUESE AZULEJOS

Paola Calicchia^{a*}, João Manuel Mimoso^b, Dória Maria Rodrigues Costa^b

^a Institute of Acoustics and Sensor “O. M. Corbino”- IDASC – Via Fosso del Cavaliere 100, 00133 Rome, Italy

^b Laboratório Nacional de Engenharia Civil – LNEC – Avenida do Brasil 101, 1700-066 Lisbon, Portugal

Azulejos, the Portuguese glazed ceramic tiles, are a durable architectural finishing, but degradation phenomena induce tiles' detachments from the supporting wall, or glaze delaminations from the ceramic substratum when shear forces act at the interface. Presently no tool, commonly used for in situ diagnostics, reveals glaze delaminations in the early stages, when no decay is visually evident.

An acoustic technique, ACoustic Energy Absorption Diagnostic Device – ACEADD - based on the absorption evaluation in the studied structure, was employed on site to localize glaze delaminations in azulejo panels.

The method detects the presence of hidden cavities within walls exciting the structure through a sound wave and measuring the acoustic energy absorption coefficient, that fraction of energy not reflected back by the surface. Excited by an acoustic field, a detachment behaves as a selective acoustic absorber, vibrating at specific frequencies related to its thickness, while a rigid wall reflects back all the incident energy.

Employing a non contact setup, the equipment automatically scans an area, radiating towards the surface an acoustic wave with audible frequency content and recording the reflected wave. A suitable signal processing provides a map, localizing the defects where the absorption coefficient is high.

In the renaissance cloister of the Madre de Deus Convent in Lisbon, housing the National Tile Museum, azulejo panels depicting extensive loss of glaze were analyzed. Acoustic absorption maps confirmed the presence of further delaminations in tiles already affected by glaze loss, and revealed hidden cavities in apparently undamaged tiles. Frequency analysis indicated the existence of thin cavities, few microns thick.

The ACEADD constitutes a low cost, portable system for non destructive evaluation of decay, suitable for wide area scan and tunable to defects scale. Properly integrated in an extensive and preventive investigation, it can provide important indications on the presence and size of subsurface cavities, preventing the loss of the glaze layer with its pictorial content.

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**Corresponding author's E-mail address:* paola.calicchia@idasc.cnr.it