

COMBINED NON-DESTRUCTIVE TECHNIQUES FOR CURING MONITORING OF TRC PLATES

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Due to the complex forms and geometries that can be accomplished by textile reinforced cementitious (TRC) composites, accelerated growth in the use of these materials has taken place. However, the complex mechanical and fracture behavior of these materials urges the need for a reliable technique that determines and verifies its correct fabrication. Therefore, a combination of non-destructive testing (NDT) techniques is applied in this paper to study the curing process and provide feedback on the optimal curing conditions, such as temperature, humidity, and curing time. In this case, two NDT established techniques (Ultrasonic testing and infrared thermography) will serve as benchmarks for the millimeter-wave (MMW) spectroscopy which has not yet been applied in TRC. Ultrasonic testing (UT) is an NDT in which a transmitter sends ultrasonic pulses through a sample, and the pulses are received by a transducer (both known positions). This way, the velocity and the attenuation of these elastic waves can be measured allowing possible correlations with the mechanical properties and, in this case, with the evolution of curing through time. On the other hand, in order to monitor the heat evolution and the uniformity of TRC during curing, non-contact infrared thermography was used. This test is expected to obtain a uniform thermal distribution, with slightly higher temperatures in the center of the plates. Finally, MMW spectroscopy, through the measurement of electromagnetic transmission and reflection, was used to continuously monitor the physical and chemical parameters of TRC during curing, showing sensitivity to the chemical processes at microstructural levels. This study shows a good consensus on the results of the various techniques, which apart from the experimental observations, attempt to explain the behavior based on the chemical reactions of the hydration of cement and the stiffness gain in the cement matrix. Finally, the possibility of industrial application is also discussed in the paper.