

Electrical and Thermal Properties as an Indicator for Setting Time of Concrete

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Abstract - The process, rate, and quality of cement hydration affect the properties development of concrete, such as its compressive strength, penetrability, and setting. Among all, setting time is one of the important properties for the concrete industry. The accurate determination of the setting time in concrete projects has always been a question. Setting time is traditionally measured in laboratory setups using the Vicat needle (as standardized in ASTM C191). However, the field condition of a concrete pour is different from a laboratory setup, so it is important to replace the lab-based setting time test with an alternative method applicable to the field. Proposing a test method, which not only estimates the setting time but also considers the actual job site conditions, is essential. In this paper, the development of setting time using the Vicat method of three cement paste mixtures is studied for the first 24 hours from mixing. The electrical resistivity and temperature evolution of the cement pastes are monitored during the same period. From the results, it is observed that the changes in the electrical resistivity in conjunction with changes in the temperatures of the fresh cement pastes are related to the setting times as measured by ASTM C191. Correlation between the changes in the electrical resistivity and temperature of the cement pastes with the setting times development can result in a practical method for estimating the in-place field setting properties.

Keywords: Cement Paste, Vicat Test, Setting Time, Fresh Properties, Electrical Resistivity.