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Self-Sensing Concrete: A Breakthrough in Structural Health Monitoring- A review

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Conventional concrete acts solely as a structural material. It has no or very little sensing property. Self-sensing concrete is fabricated by adding functional fillers such as Carbon fibers, steel fibers, and Carbon nanotubes into a conventional concrete matrix. Stress, strain, crack, or damage in itself of concrete can be sensed through these functional fillers without disturbing or even improving the mechanical properties of concrete. Therefore, self-sensing concrete has both sensing and structural capabilities. Structural Health Monitoring (SHM) is a technology that provides data on the performance of structures at the initial stages before any serious damage occurs. Self-sensing concrete is a promising replacement for the traditional embedded or attached sensors used for SHM which suffer from high cost, low durability, and limited sensing volume. In the recent past much work has been done towards the development of self-sensing concrete and innovative achievements have been obtained. This paper reviews the concepts of smart civil engineering structures, structural health monitoring, self-sensing concrete, sensing mechanisms, conductive additives and concrete matrix. The performance of self-sensing concrete depends on various factors such as the type of external loading, type of functional fillers, concentration of functional fillers, properties of concrete matrix, and fabrication method. Therefore, calibration of self-sensing concrete becomes challenging, making it one of the main drawbacks of self-sensing concrete. The review underscores the importance of continued research and experimentation to unlock the full potential of self-sensing concrete for sustainable infrastructure development.

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