Abstract for the general public

The aim of this research work is to develop a new type of concrete that can heal itself. The intention of this study is to investigate the use of iron-based shape memory alloy (SMA) fibers as reinforcement in high-performance concrete.

SMA materials have a unique phenomenon known as the shape memory effect when exposed to sufficiently high temperatures, in which the alloy may recover to its original shape after deformation. By incorporating SMA fibers into concrete, we aim to develop a self-healing material that can repair cracks and maintain structural integrity over time.

Engineers are interested in self-healing concrete because of its potential advantages. Consider a scenario in which buildings, bridges, and other infrastructure can repair themselves with minimal human intervention. Concrete cracks are a common issue that can lead to costly repairs as well as safety issues. By creating self-healing concrete, we can reduce maintenance costs, extend the lifespan of structures, and enhance their resilience to natural disasters.

To achieve these goals, extensive research and testing will be conducted. SMA fibers with a specific diameter of 0.5 mm and a total length of 35 mm will be added to the concrete mixture. Chemical additives will be added to the mixture to increase its viscosity, ensuring uniform fiber dispersion and preventing settling throughout the mixing and casting operations.

The concrete samples will be distorted and their behavior will be regularly observed during the testing phase. Fracture breadth and length will be properly measured using advanced imaging technologies. The performance of self-healing concrete reinforced with SMA fibers will be compared to that of ordinary concrete reinforced with steel fibers, allowing us to better comprehend the effectiveness of the self-healing mechanism.

The anticipated outcomes of this research project will have significant implications for the construction industry. Self-healing concrete has the potential to revolutionize the way we build and maintain structures. It has the potential to boost safety, sustainability, and cost-effectiveness.