TOWARDS COOLING CONCRETE: EVALUATION OF CEMENT AND CEMENT COMPOSITES UNDER REALISTIC CLIMATIC CONDITIONS

To fully harness the potential of Passive Daytime Radiative Cooling (PDRC) in the context of energy-efficient buildings, it is essential to develop materials capable of covering roofs and building envelopes. These materials must be applicable to surfaces of various shapes, sizes, and textures, resistant to environmental chemicals, solar radiation, and weather conditions, while also being affordable and accessible across different socioeconomic settings, particularly in developing countries.

The MIRACLE Project aims to tackle these challenges by focusing on cement, the second most widely used material in the world. In one of its initial findings, the project examined the scattering and absorption efficiency factors of tobermorite (CSH) and portlandite (CH), two primary phases of cement. The study suggests that, with proper optimization of composition and porosity, ordinary concrete could be transformed into a viable material for PDRC [J.S. Dolado et al. (2024), Radiative Cooling Properties of Portlandite and Tobermorite: Two Cementitious Minerals of Great Relevance in Concrete Science and Technology, ACS Appl. Opt. Mater. doi.org/10.1021/acsaom.3c00082].

In this scenario, the present work [**Alicia E. Torres-García et al. (2025), Towards cooling concrete: Evaluation of cement and cement composites under realistic climatic conditions, Appl. Therm. Eng.**, **doi.org/10.1016/j.applthermaleng.2025.125531**] gives a step further and quantitatively evaluate for the first time the actual radiative cooling power of CH and CSH across three distinctive geographical locations in a period of one year, in comparison with two common cement pastes made from a grey Ordinary Portland cement and white cement.

The findings demonstrate the potential of CH to achieve sub-ambient daytime temperatures more than 90% of the time in dry desert and warm temperate climates. This research paves the way for innovative cooling concretes that require no additional whitening agents or potentially harmful particles, offering a sustainable and practical solution to prevailing cooling challenges.

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MIRACLE Photonic Concrete

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