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Formation of magnesium silicate hydrate gel in magnesium silicate cement: An overview

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ABSTRACT

Magnesium silicate cement (MSC) is a sustainable alternative to Portland cement (PC) due to its lower calcination temperature, reduced carbon emissions, energy consumption during its production, and waste utilization [1]. In MSC, strength and durability rely on magnesium silicate hydrate (MSH) gel formation, similar to calcium silicate hydrate gel in PC [1]. MSH gel enhances resistance to sulfate and chloride ingress, expanding MSC applications to thermal insulation, 3D concrete printing, and waste immobilization [2]. The properties of MSH gel depend on the purity of the raw material, mixture composition, water-to-binder ratio, curing conditions, pH, and curing duration [3]. Optimized Mg/Si ratio, curing temperature, low pH, and extended curing time can improve the stability and strength of MSH gel, while accelerated curing, alkali additions, and lower Mg/Si ratios can enhance its formation [3]. This study reviews factors influencing the formation, strength, and stability of MSH gel in literature [2-4]. Additionally, a preliminary study on the behavior of MSH gel under an accelerated carbonation curing condition is presented, providing insights for future research and applications [5].

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