

Optimizing Ternary Cement Mixes: Phase Diagrams for Portland Cement-Slag-Fly Ash Blends

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ABSTRACT

The study examines several combinations of binders comprising Portland cement, slag, and fly ash, with proportions ranging from 30-100, 0-50, and 0-50, respectively. Thermodynamic equilibrium of this ternary cement systems was simulated by combining thermodynamic modeling with modeled degree of reaction of slag and fly ash, which change based on the binder compositions. The findings indicate that a 56% replacement of supplementary cementitious materials (SCMs) is possible without substantially affecting the production of C-(A)-S-H. Furthermore, it is discovered that ettringite and straetlingite are stable in the same cementitious material combinations, while ettringite becomes unstable in mixes that promote monosulfate production. Overall, this study demonstrates an alternative approach for selecting an acceptable amount of binders to create blends that complement one another and provide features that are particular to the application. The findings might significantly contribute towards designing and optimizing ternary cement formulations.

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