Postprint: Effect of Admixtures on Strength and Microstructure of Ceramsite Concrete

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Abstract

The composite admixture of fly ash and gypsum powder in ceramsite concrete represents a novel material that can achieve waste utilization, pollution reduction, and strength enhancement, thereby contributing to energy conservation and environmental protection. By varying the mix proportions of fly ash and gypsum powder admixtures, multi-age compressive strength tests were conducted to analyze the influence of gypsum powder content on the compressive strength of fly ash ceramsite concrete, and scanning electron microscope (SEM) technology was employed to analyze the microstructure. The results demonstrate that when the fly ash admixture is 40%, the compressive strength of specimens exhibits a trend of initially increasing and then decreasing with increasing gypsum powder content; at a gypsum powder admixture of 22%, the compressive strength reaches its maximum; the combined admixture of 22% gypsum powder and 40% fly ash can enhance the compressive strength and render the microstructure more compact, with more hydration products beneficial to strength; conversely, the microstructure becomes loose with fewer hydration products; the interface transition zone (ITZ) of specimens with higher strength is more compact.

Full Text

Preamble

This section establishes the mathematical foundation for our analysis. We begin with the core definitions: MATH_{0001} , MATH_{0004} , and MATH_{0006} . These expressions form the basis for subsequent derivations and analyses presented in this work.

The rigorous formulation of these fundamental concepts is essential for ensuring the validity and reproducibility of our results. Each definition has been carefully constructed to capture the essential properties of the underlying system

while maintaining mathematical tractability. We explicitly denote the parameter spaces and functional relationships that govern our model's behavior, thereby providing a clear framework for the theoretical developments that follow.

Furthermore, these definitions serve as the common language through which we articulate our methodological innovations and empirical findings. By establishing precise mathematical semantics upfront, we enable readers to follow the logical progression of our arguments without ambiguity. The notation introduced here will be used consistently throughout the remainder of the paper, and we encourage readers to refer back to these foundational expressions when encountering later derivations.

Note: Figure translations are in progress. See original paper for figures.