

Understanding the Role of Alkali-Free Accelerators in Wet-Mix Shotcrete

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Abstract : Most of the shotcrete projects require compliance with meeting a specified early-age strength target (e.g., reaching 1 MPa in 1 hour) that is selected based on the underground conditions. To meet the desired early-age performance characteristics, accelerators are commonly used as they increase early-age strength development rate and accelerate the setting thereby reducing sagging and rebound. The selection of accelerator type and its dosage is made by the setting time and strength required for the shotcrete application. While alkaline and alkali-free accelerators are the two main types used in wet-mix shotcrete; alkali-free admixtures increasingly substitute the alkaline accelerators to improve the performance and working safety. This paper aims to evaluate the impact of alkali-free accelerators in wet-mix on various tests including set time, early and later-age compressive strength, boiled absorption, and electrical resistivity. Furthermore, the comparison between accelerated and non-accelerated samples will be made to demonstrate the interaction between cement and accelerators. Scanning electron microscopy (SEM), fluorescent resin impregnated thin section and cut and polished surface images will be used to understand the microstructure characterization of mixes in the presence of accelerators.

Keywords : accelerators, chemical admixtures, shotcrete, sprayed concrete

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