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Compatibility matrix of superplasticizers in Ultra-High-Performance concrete for material sustainability

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Aims and scope

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Abstract

The research work aims at outbreaking the fundamentals by distinguishing the varying superplasticizers by its workability, strength, and behavior on Ultra-High-Performance Concrete (UHPC). The UHPC works under a low water-binder ratio where the workability is maintained through the addition of superplasticizers. Superplasticizers are of four types, namely Sulphonated Naphthalene Formaldehyde (SNF), Sulphonated Melamine Formaldehyde (SMF), Sulphonated Acetone Formaldehyde (SAF), and Polycarboxylate Ether (PC). The present research work is a comprehensive study focusing on the influence of superplasticizers such as type, dosage, fresh, and hardened state properties on UHPC. With this background, the present study was carried out to analyze the performance of UHPC through three types of superplasticizers such as SNF based—Hi-plast S50, SMF based—BPC—M20, and PC based—Master Glenium 51 at a consistent dosage of 0, 0.5, 1, 1.5, and 2%, respectively, with a constant percentage of glass fiber (2.5%) and silica fume (15%) to the weight of cement. Out of three superplasticizers, PC-based admixture showed a good impact with moderate workability retention and water reduction of 20–35%. The saturation dosage was attained at 1.5% of PC-based admixture. The outcome of the present study is expected to break through the fundamentals of superplasticizers and their applications in UHPC. Based on the observation, it is recommended that PC-based admixtures are more prominent than sulphonated superplasticizers in terms of water reduction, workability, and strength aspects.

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