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Comparison of the effect of superplasticizing admixtures on the processes of cement hydration during mechanochemical activation

Ibragimov R., Pimenov S., Kiyamov I., Mingazov R., Kiyamova L.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

© 2016 Ruslan Ibragimov, Sergey Pimenov, Ilham Kiyamov, Ramil Mingazov, Laysan Kiyamova.The results of the study of the influence of two different super-plasticizers on the peculiarities of the process of hydration during mechanochemical activation (MCA) of a binder are given. The influence of SAS admixtures during the MCA of a binder on the kinetics of heat release and the alkalinity of the liquid phase of cement slurry is revealed. Technological properties of concrete mixture and physicomechanical properties of heavy-weight concrete, obtained by the MCA of a binder with the SAS admixtures, were studied. Dependencies of the influence of SAS on the processes and the nature of cement hydration were established, as well as on granulometric and phase composition of hydrated new formations. It was established that the application of SAS admixtures at the MCA of a binder makes it possible to substantially increase the efficiency of cement dispergation, which manifests itself in the decrease of grain sizes and the increase in specific surface area. The MCA of a binder with SAS admixtures makes it possible to obtain homogeneous cement suspension with the uniform distribution of water in the volume of cement, which positively affects physicomechanical properties and the quality of the obtained concrete. The application of SAS admixtures at the MCA of a binder results in the reduction of induction period of hydration by 2-5 hours, and also in the acceleration of crystallization period by 5-7 hours faster than in the reference compositions. MCA of cement suspension with SAS admixtures leads to the increase in the density of concrete mixture and a substantial increase in the strength limit of heavy-weight concrete at compression during all periods of hardening. With the MCA of a binder with SAS, an increase in the amount of crystalline phase by 10-12 % is observed in the first twenty-four hours of hardening, which confirms the conclusion about acceleration of cement hydration with the joint use of SAS and MCA. According to the results of a comprehensive study we received new data of the influence of super-plasticizing admixtures of different chemical bases on the peculiarities of the processes of hydration of a binder during MCA. The obtained data can be used for selection of superplasticizing admixtures in the production of the ferroconcrete products, obtained with the MCA of a binder, as well as in the technology of construction of buildings made of monolithic reinforced concrete.

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Keywords

Cement suspension, Heavyweight concrete, Mechanochemical activation, Modification, Superplasticizing admixtures