Heat-resisting foam concrete: forming conditions

S. N. Leonovich[1], S. A. Karpushenkov[2], A. L. Belanovich[2], L. S. Karpushenkava[2]
[1]Belarusian National Technical University, Minsk, Belarus,
[2]Belarusian State University, Minsk, Belarus, *e-mail: karpushenkov@bsu.by*

Heat-resistant foam concrete is one of the most promising refractory materials, the use of which is determined by low cost, environmental friendliness, low density and fire resistance [1]. However, low stability of foam during the production of foam concrete mixture and insufficient strength of foam concrete in the operating temperature range of industrial furnaces is a major problem in the production of this material [2]. At the same time, the use of various additives and modifiers in the foam concrete mixture allows to influence the chemical composition of the binder and the properties of the formed foam concrete during solid-phase sintering [3].

In this work, we studied the features of the formation of heat-resistant foam concrete using chemical modifiers, a two-component binder of aluminous cement and clay.

The use of additives-electrolytes leads to a change in the solubility of the products of hydration and hydrolysis in the binder. Such additives promote the removal of hydration products from the reaction zone or increase the solubility of clinker minerals. Sodium citrate is one of these additives. Earlier we showed [4] that sodium citrate increased the hydration of both Portland cement and alumina cement, and also ensured the formation of hydroaluminate nanosized particles in the gel phase, thus significantly improving the hardness of the cement stone.

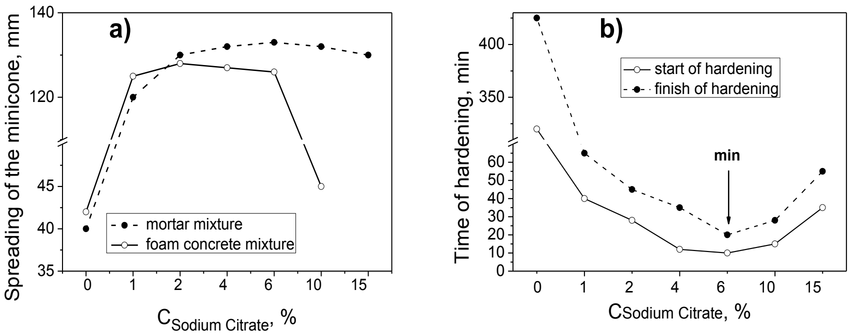

Fig . Dependence of the plasticity of the mortar and foam concrete slurry (a) andthe starting and finishing time of mortar cement mixture solidification (b), depending on the concentration of sodium citrate in water

Data in Fig. a show that sodium citrate provides maximal plasticizing effect in the range of concentrations from 1 to 6 % with respect to the cement mass. At the same time, the least time of the solidification beginning and finishing (10 and 20 min, respectively) is observed in the sodium citrate concentration range from 4 to 10 % (Fig. b). It can be assumed that the accelerating effect of sodium citrate is due to the elimination of Ca^{2+} ions from the liquid phase of the hydrated cement by binding them to poorly soluble citrates. It is obvious that the concentration of citrate equal to 6 % with respect to the cement mass is the most optimal for obtaining a mortar mixture with maximal plasticity and minimaltime of the solidification start.

Optimal concentrations of mineral additives to a dry mixture of aluminous cement, clay and chamotte in the ratio of 1 : 1 : 1 were found to be 5 % metakaolin, 5 % RSAM, 3.2 % basalt fiber, 1.7 % sodium citrate and 0.5 % "Ufapore" foaming agent. Using this composition of a dry mixture at a water-hard ratio (water/dry mix) equal to 0.45–0.7, it is possible to obtain a heat-resistant foam concrete without shrinkage cracks with a density of 300–650 kg/m^3 and a compressive strength of 0.2–2.5 MPa at natural curing and 0.3–3.2 MPa after heating at 1000 ^oC. This foam concrete, in contrast to foam concrete based on Portland cement and alumina cement, does not reduce its strength when heated, but, on the contrary, it increases after heating.

References

1. S.N. Leonovich [et. al.]. Stroitelnye Materialy [Building materials] (2017) 7:25.
2. V.M.Gorin [et. al.]. Stroitelnye Materialy [Building materials] (2003) 8 : 17.
3. T. Juetter [et al.]. J. European Ceram. Soc. (2007) 27 : 1435.
4. S. N. Leonovich [et. al.]. Stroitelnye Materialy [Building materials] (2012) 10 : 74.

Infrared spectroscopic studies of Mg-substituted zeolite Nakhchivan

G. A. Mamedova

Institute of Natural Resources, Nakhchivan Branch of the National Academy of Sciences of Azerbaijan, Nakhchivan, Azerbaijan,

e-mail: gunelmamadova@mail.ru

In recent years the use of high-silica zeolites as catalysts, filters in the oil refining, petrochemical, gas industry, in medicine, in the production of building materials, for the purification of sewage and industrial water, for the preparation of ceramic matrices became very promising [1]. It should be noted, that various