Thermostable heat-insulating materials based on solid phosphate binders and hollow microspheres

K.N. Lapko[1,2], N.S. Apanasevich[2], A.N. Kudlash[1], A.A. Sokal[1], Yu.D. Kliaulin[1], A.Yu. Siomukha[1]
[1] Belarusian State University (BSU), Minsk, Belarus,
[2] Research Institute for Physical Chemical Problems of the BSU, Minsk, Belarus
e-mail: *lapkokn@bsu.by*

Liquid phosphate binders are widely used for the manufacture of inorganic heat-resistant composites [1]. However, the liquid binders have several drawbacks and one has to face with some difficulties: over time, crystallization and polycondensation processes occur in solution. This leads to a significant complication of the subsequent technological operations.

The use of solid phosphate binders makes it possible to apply in practice a more advanced technology of dry building mixtures, which ensures the production of high quality target products based on them. The literature and investigations in which solid binders have been employed are very few and such works are related to a narrow range of compositions [2, 3].

Inorganic hollow microspheres (HMS) are one of the promising fillers for thermostable heat-insulating materials (THIM) [4]. During the traditional process of composition preparation by the mixing of lliquid phosphate binders with solid abrasive fillers (corundum, chamotte, etc.) the destruction of HMS occurs. This fact leads to a decrease of HMS efficiency utilization for obtaining. Therefore, in this work we used the technique of the mixing solid binder and fillers in an air-suspended state, which practically does not lead to the destruction of hollow microspheres. In present research, $Mg(H_2PO_4)_2 \cdot 4H_2O$ was used as a solid phosphate binder, the main filler was a mixture of Al_2O_3(M5) and AlN. Ash HMS and glass HMS were used as a functional fillers.

As a result, the optimal formulations of heat-insulating composites have been developed. It has been found that the content (wt. %) of the main filler is 10–15, and the content of $Mg(H_2PO4)_2 \bullet 4H_2O$ varies in the range from (15–20) for THIM based on ash HMS to (60–70) for THIM based onaglass HMS. The values of the compressive strength and density for the developed composites based on ash microspheres reach 2.5–5.5 MPa and 0.5–0.8 g/cm^3, respectively; for the composites based on glass microspheres these values are 1.0–2.5 MPa and 0.4–0.6 g/cm^3.

References

[1] L.G. Sudakas. Phosphate bonding systems. St. Petersburg (2008), 260 p.
[2] K.N. Lapko, et al. ALITinform (2015) 39:1
[3] T.N. Shulha, et al. Izvestiya of St. Petersb. Tech. University (2017) 38:95
[4] A.N. Kudlash, et al. Sviridov Readings (2004) 1:120