

MICROSPHERES BASED ON GOLD WASTE IN STREAM HIGH-TEMPERATURE GAS¹

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This paper presents the investigation results on a possible use of ash-based raw material for the silica-alumina microsphere production through the plasma processing. The formation of ash-based microspheres can be considered as the silicate formation process, because the obtained particles represent hollow droplets of the silicate melt.

The main parameters of plasma-assisted powder processing include the temperature and the rate of plasma flow. The distribution of temperature fields and rates in plasma flow is rather complex [1]. In our experiment, we use the electro-plasma installation designed at the Department of Applied Mechanics and Materials Science (TSUAB) to produce microspheres based on refractory oxides and silicates. This installation comprises plasma generator (cathode), hollow graphite electrode and a chamber for collection of the processed material [2-5].

As a result of our experiments, we obtain microspheres with $0.4 \div 0.6$ g/cm³ bulk density and $90 \div 120$ μ m particle diameter. The decrease in the bulk density occurs due to the increase in the relative amount of absorbed air inside a particle occurred during the high-temperature heating. The reduction in the particle size is connected with the growth in the degree of density between the particles caused by melting of agglomerated fine particles.

The XPS investigation allows obtaining the distribution maps for the elemental composition of the microsphere surface and detecting the element concentration. The plasma processing homogenizes the particles. The elements distribute uniformly over the particle surface. The plasma processing has a positive effect on the particle morphology, i.e. they acquire a spherical shape and have no surficial defects.

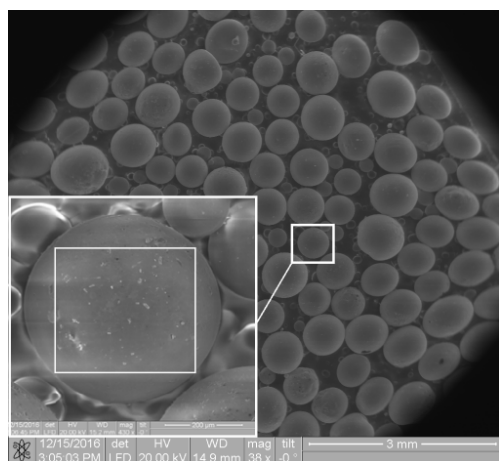


Fig. 1. SEM image of ash-based microspheres obtained by plasma processing. Enlarged view contains the fragment of the elements distribution area.

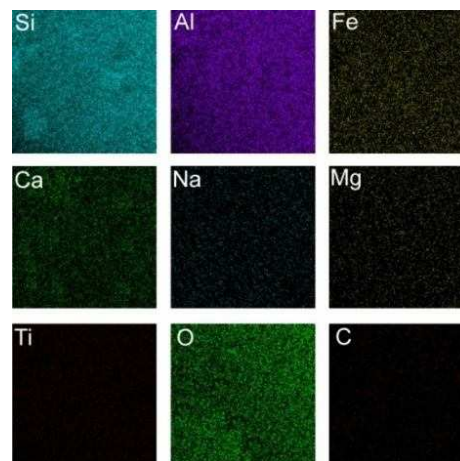


Fig. 2. Qualitative surface distribution of chemical elements after plasma processing

Summing up the results, it can be concluded that microspheres can be obtained from the bottom ash waste (Belovo Power Plant, Kemerovo region) processed by plasma energy. The designed electro-plasma installation was used to produce microspheres from agglomerated powders based on the bottom ash waste. The X-ray photoelectron spectroscopy allowed obtaining the distribution maps for the elemental composition of the microsphere surface and detecting the element concentration.

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