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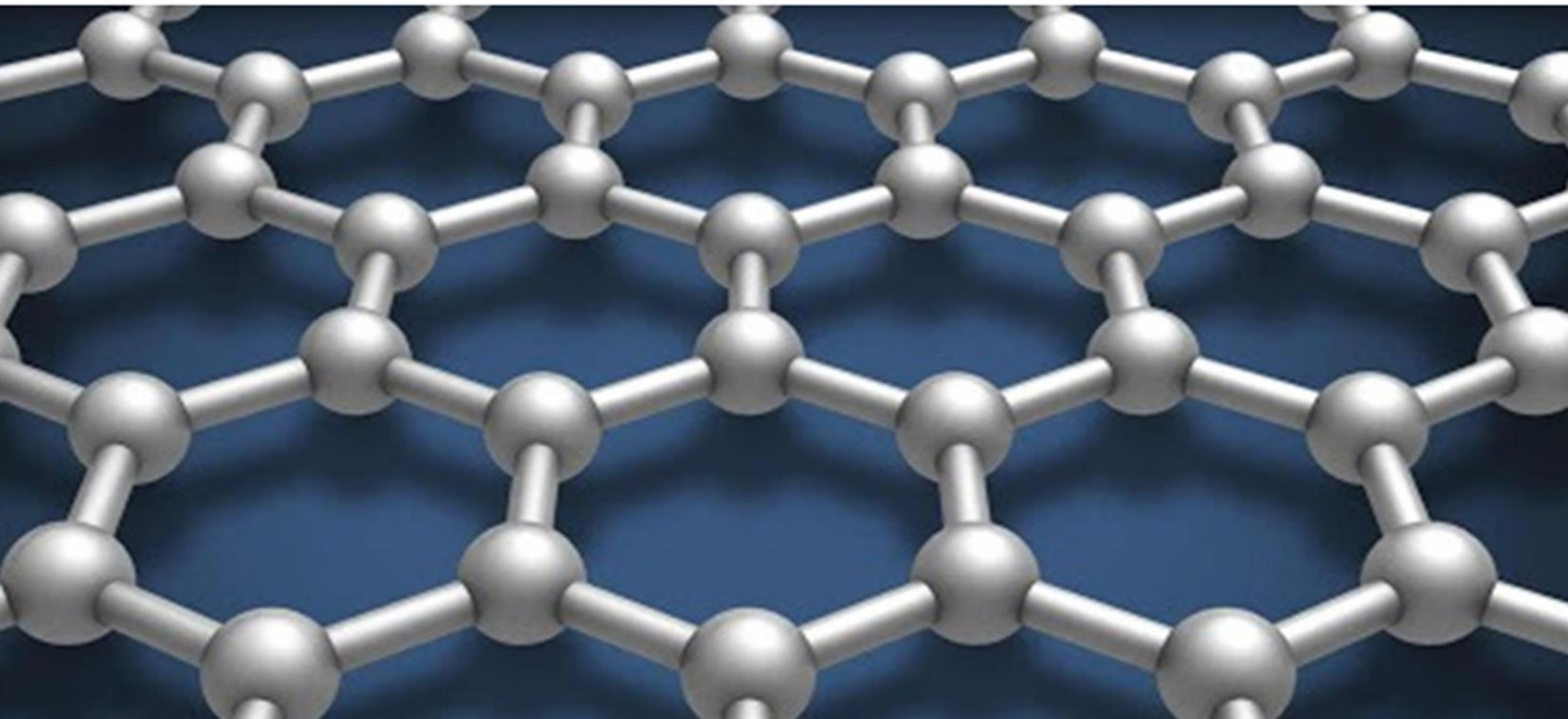

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Композиционные материалы

PHYSICO-CHEMICAL CHARACTERISTICS OF TECHNOGENIC WASTE IN FERROALLOY PRODUCTION AND THEIR PROCESSING AT JSC "UZMETKOMBINAT"

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Introduction. Currently, one of the primary directions of scientific research in non-ferrous metallurgy is the integration of industrial technogenic waste processing into primary production. Positive results have been achieved in the republic in this regard.

At JSC "Uzmetkombinat," significant attention is devoted to enhancing technological processes, minimizing industrial waste generation, and developing and implementing innovative technologies that facilitate the utilization of secondary raw materials and energy resources within the plant. The goal of these technologies is to maximize the extraction of metals and valuable products from the plant's technogenic waste by involving them in further processing.

During a video conference meeting on December 3, 2020, dedicated to the development of science and innovation, the President of the Republic of Uzbekistan, Sh.M. Mirziyoyev, emphasized the importance and urgent need for processing technogenic waste accumulated at enterprises in the mining and metallurgical industry of Uzbekistan [1].

Thus, one of the pressing tasks at JSC "Uzmetkombinat" is the utilization of technogenic microsilica waste. This material serves as silicon-containing raw material for producing new types of products, one of which is liquid glass (sodium silicate binder) [2-4].

Selection of research objects. The waste product, microsilica, is carried out from the ore-reduction furnace and captured in the dust collection system. At JSC "Uzmetkombinat," approximately 600 tons of microsilica are generated monthly. Currently, a small portion of the microsilica is sold to the construction industry and used as a component in cement production, while the remainder is stored in designated areas.

During the study, an analysis of technologies for producing sodium silicate binder via a non-autoclave method was conducted to determine the direction of further research, along with sample collection. The microsilica was analyzed for chemical composition using methods such as atomic emission spectroscopy with inductively coupled plasma (AES-ICP), semi-quantitative spectral analysis, X-ray spectral analysis, and silicate analysis.

Discussion of the research results. The characteristics, average chemical composition, volume, and granulometric composition of waste materials and aspiration dust from technogenic waste generated in the ferroalloy production workshop at JSC "Uzmetkombinat" are presented in Table 1.

The technogenic wastes listed in Table 1, including ferrosilicon (grade FS-65) and ferrosilicomanganese (grade MnS-17), produced during ferroalloy manufacturing at JSC "Uzmetkombinat," can be utilized in research aimed at repurposing these wastes for liquid glass production, as outlined in the technological scheme provided in the study [5]. The value of these technogenic wastes lies in their silicon content in the form of microsilica, which is generated during the production of FS-65 ferrosilicon. Additionally, 85% of the silicon in this waste is in a finely ground form.

Therefore, a highly relevant task at JSC "Uzmetkombinat" is using FS-65 ferrosilicon technogenic waste, specifically micro silica, as silicon-containing raw material for producing new types of products, such as liquid glass (sodium silicate binder).

Conclusion. Research was conducted on the use of technogenic microsilica waste (FS-65) in the production of liquid glass. The content of silicon dioxide and sodium oxide in the obtained sodium silicate binder solution was determined in accordance with GOST 13078-81, and the silicate modulus was calculated to be 2,7–3.0.

Table 1.

Characteristics of Waste from FS-65 Ferrosilicon and MnS-17 Ferrosilicomanganese in Ferroalloy Production

№	Material Name	Waste Volume, tons	Monthly Generation, tons/month	Moisture, %	Bulk Density, g/cm³
1	Coal fines	0	150	0,5-20	0,7-1,5
2	Quartzite screenings	6500	700	0,5-20	1,6-2,5
3	Aspiration dust (FS-65 ferrosilicon, microsilica)	3113	450	Н.б.3	0,3-0,4
4	Aspiration dust (MnS-17 ferrosilicomanganese)	16	6-7	0,2	0,3-0,4
5	FS-65 ferrosilicon fines after crushing	1118	150	Н.б.0,5	2,55
6	MnS-17 ferrosilicomanganese fines after crushing	0	60	Н.б.0,5	3,14
7	FS-65 ferrosilicon dust after crushing	41	3-4	Н.б.0,5	1,09
8	MnS-17 ferrosilicomanganese dust after crushing	3	1.5	Н.б.0,5	2,11
9	Ferrosilicon slag	140	15-19	0,08	2,04
10	Ferrosilicomanganese slag	0	300-370	0,08	1,78