

AP19576811 “Development of technology for obtaining a conditioned product from highly dispersed dust of ferroalloy production” – p.m. Issagulova D.A.

Relevance

A large number of by-products is generated during ferroalloy production: slag, fine fraction deposits of ore raw materials and finished products (ferroalloys), sludge, dust, and other materials. Their use and processing help reduce the consumption of primary raw materials, thereby increasing the efficiency of the main production and reducing environmental pollution. The greatest ecological risks come from technogenic waste in the ferroalloy industry, which consists of fine-disperse materials such as dust and sludges from various production processes. One of the main methods for agglomerating powdered substances is briquetting, a process that requires energy only for shaping the briquettes and compacting them, without the need for thermal energy for sintering. Briquetting is the most cost-effective and compact method for pelletizing various powdery materials, making it economically feasible to pelletize production waste using briquetting presses.

Objective of the project: to create a new technology for producing ferrosilicon briquettes from high-dispersed dust of ferroalloy production using a new complex binder material.

Expected and Achieved Results

2024 Results:

- Research has been conducted on the use of various components as binders for briquetting high-dispersed dust (HDD);
- The composition of the charge and a complex binder based on water glass and bentonite clay have been developed. The ratios of additives ensuring the mechanical strength and chemical stability of the briquettes have been studied;
- It has been determined that the hardening mechanisms are related to the coating of dust particles with clay and their adhesive bonding in the water glass medium.
- Experimental smelting tests were carried out at the production sites of “RPA Manganets” LLP and “Pakhomenko KMZ” LLP with partial use of experimental briquettes;
- A preliminary technological process map has been compiled.

Published:

- 1 article in a Scopus-indexed journal (CiteScore 35%);
- 1 article in a journal from the CQAES database.
- A patent for a utility model has been granted in Kazakhstan.

Project Implementation Outcomes:

- A new composition of briquetted ferrosilicon will be obtained;
- A new technology for producing strong briquettes from dust will be developed;
- The mechanism of interaction between high-dispersed dust from ferroalloy production and the new complex binder material will be determined.



a



b

Figure 1 - Sample 4: a - before testing; b - after testing		
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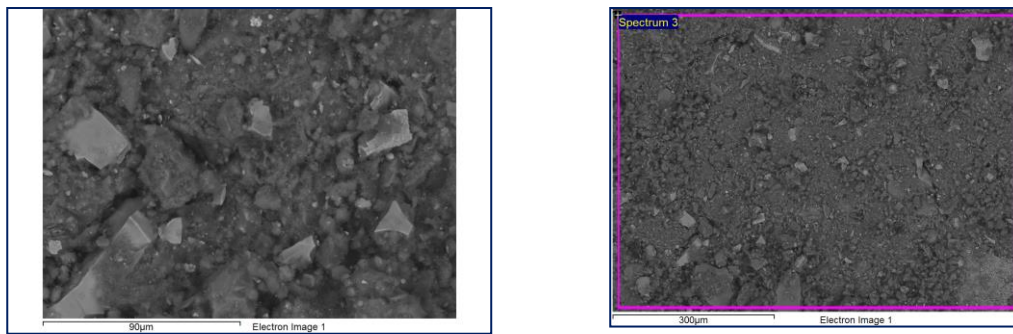


Figure 2 - X-ray diffraction analysis of briquette sample

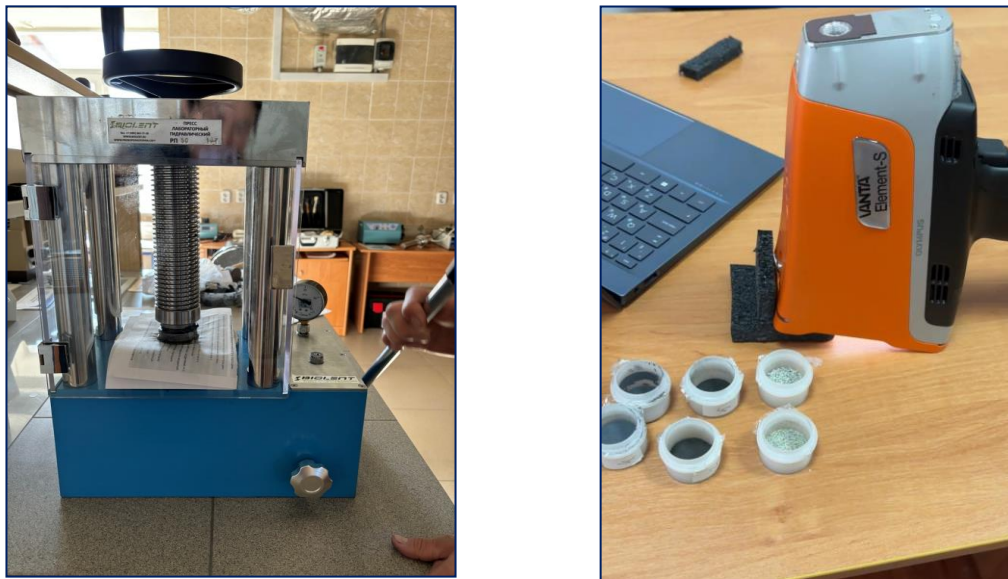


Figure 3 - The process of conducting experiments

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List of Publications:

1. Omarova A.E., Issagulova D.A., Kvon S.V.S., Kovaleva T.V. "Selection of Binder for Briquette Production from High-Dispersed Dust of Ferroalloy Production" DOI 10.52209/1609-1825_2023_3_79. Journal of the University, No. 3 (92), 2023. <http://tu.kstu.kz/archive/journal/26>

2. D.A. ISSAGULOVA, SV.S. KVON, A.E. OMAROVA, T.V. KOVALEVA, V.YU. KULIKOV, A.A. ALINA/ Studying the binder effect on the properties of briquettes of ferroalloy production waste. ISSN 0543-5846 METABK 63(1) 143-145 (2024). METALURGIJA Journal 63 (2024) 1, 143-145. Croatia.

3. Patent for Utility Model. Authors: Omarova A.E., Issagulova D.A., Kovaleva T.V., Alina A.A. No. 8617, 10.11.2023.

4. Erzhan A., Kvon Sv.S., Issagulova D.A., Kulikov V.Yu., Kovaleva T.V. «The possibility of using iron ore concentrate as a binder when briquetting waste of ferroalloy production» // METALURGIJA 63 (2024) 3-4, 454-456. (Croatia). (Scopus percentile – 35, CiteScore 1,2), P454-456. - <https://hrcak.srce.hr/en/file/456164>

5. Patent for Utility Model No. 9155, 24.05.2024. “Method of Briquetting Powdered Waste Produced in Ferroalloy Production.” Authors: Issagulova D.A., Erzhan A., Kulikov V. Yu., Kvon S.V.S., Kovaleva T.V., Adamova G.Kh.

6. Erzhan A.E., Kvon Sv.S., Okishev K.Yu., Isagulova D.A., Kovaleva T.V. The use of clay as a binder in briquetting finely dispersed dust of ferrosilicon production. №4, 2024 г.

Information for Potential Users

The obtained results serve as a basis for more detailed research on the development of pressing and drying regimes from high-dispersion dust with Kazakhstan content for the production of a conditioned product.

Scope of application

Metallurgy, Ferroalloy Production.

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