

## Steelmaking slags use in composite materials production

The situation with industrial giants waste – mining, metallurgical, heat-and-power engineering – has risen up into a huge economic and ecological problem in Russia. These enterprises pollute the environment - soil, water recourses and atmosphere. They destroy fauna and have a destructive effect on a human body.

The use of construction composite local secondary recourses - fuel and energy complex waste (figure 1) - as raw materials will help to solve the problem of technogenic formations utilization (the release of large areas of useful land occupied by these waste) and resource conservation.

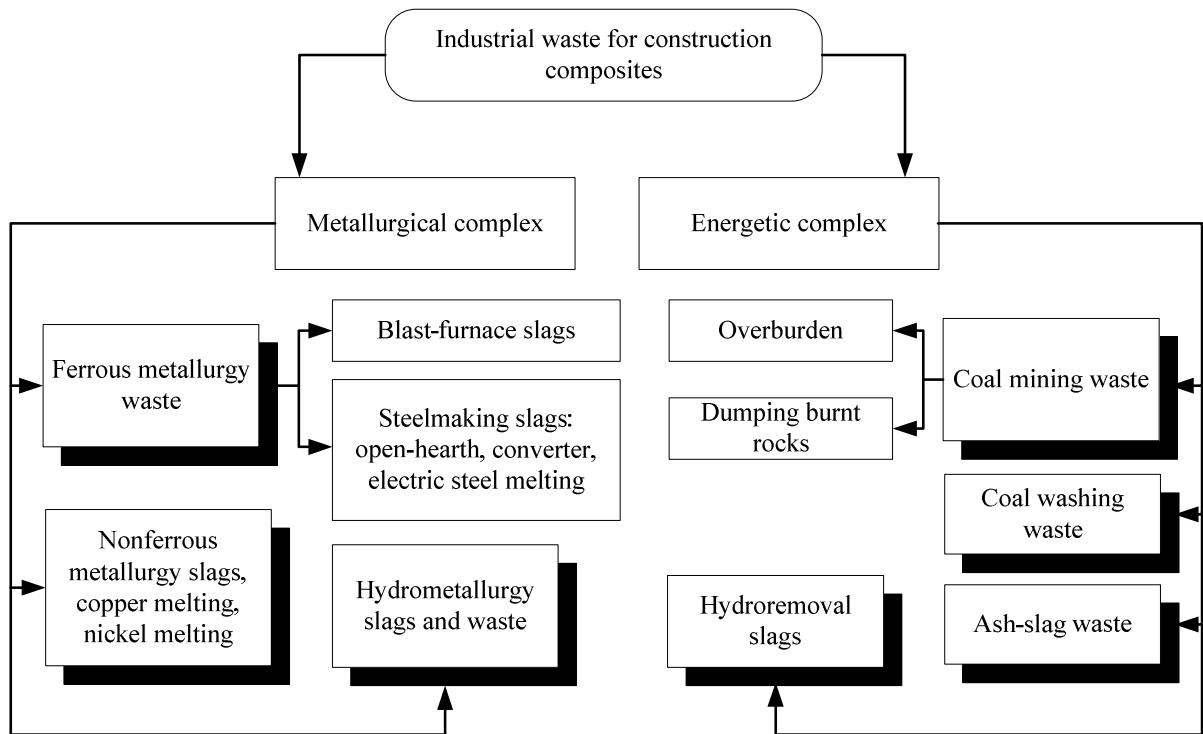


Figure 1 - Fuel and energy complex waste

Development of technologies and formulations of fuel and energy waste with low cost will impact on production cost. It is possible to produce qualified construction composites out of waste which are equal to the consumer properties produced by using traditional technologies, and even many times greater than their technology which has no large energy consumption.

In fact, there are significant reserves in the use of large-capacity metallurgical waste, large reserves of which are available in many regions of Russia. RAACS specialists have calculated that the rational use of these secondary industrial products of only current output, first of all from metallurgy and fuel energy, allows to meet the needs of industrial enterprises in astringent and fillers for concrete for more than 50% nowadays.

The feature of the Kuzbass source of raw materials is the presence of industrial mineral raw materials in large volumes. And especially it is necessary to mention the city of Novokuznetsk, where metallurgical giants such as KMP, WSPC, aluminum and ferroalloy plants and mining enterprises such as mines and open pits are concentrated.

In strategy of socio-economic development of Siberia until 2020 approved by the Federal Government on July 5, 2010 (№1120) the main directions, mechanisms and achievement means of strategic goals of Siberia development for the period up to 2020 are defined. It is noted that "... the novation processes in the real sector of Siberia economy (innovative enterprise activity, new products release and the number of used new production technologies developing slowly than in the Russian Federation as a whole) One of the steps involves an intensive development of the innovation system, "... connected with new materials and recycling of mining metallurgical industry waste. Enterprises carrying out complex processing and product release with high added value in the disposal of dumps and mining industries waste will be organized in Siberia. This will release large areas... in the end, the implemented technologies will affect the ecology, allow to export competitive products and lead to a reduction in price of construction materials in the home market.

In a study performed in Siberian State Industrial University, in accordance with the approved strategy of socio-economic development of Siberia, a transaction to non-waste technology and the use as a raw material for cement-free composite bulk waste steelmaking slag of current output: open-hearth, LLC "Steel NC "[1], converter and electric furnace of JSC" ZSMP "[2] is suggested.

A variety of chemical and mineral composition, unstable structure, a high content of iron and metal inclusions (regulus and scrap), makes it difficult to recycle steel slag for further use.

Due to these reasons steelmaking slags are the least in demand in the construction materials industry. In Russia, they annually produce more than 7.0 million tons: 2.83 million tons of open-hearth (the largest number - 180 kg / ton of steel), 3.23 million tons of convectors (150 kg / ton of steel) and 0,740 millions of tons of electric furnace. Of the total steel slags produced (their relative output is an average of 130 - 220 kg / tons of steel) about 10% is disposed. The main mass is stored in the dumps since the emergence of companies and grows from year to year. On the territory of Russia and CIS slag dumps reserves reach more than 500 million tons today.

At the same time steelmaking industrial slag is characterized by its unique totality of technical advantages as well as by favorable economic indicators which provide it with high competitiveness while making decision about its secondary use.

Technical expediency of alternative options of slag use development is stipulated by:

- instability of chemical composition
- slag inability of independent solidification and strength increase
- inclination to silicate disintegration

The initiator of recycling metallurgical industrial slag problem solution was an academician I. F. Bardin. "Slags are not waste as it has been considered during centuries and as it is considered now by negligent industrial managers... - he wrote, - slags are hundreds of millions of rubles and thousands of new houses, it is a basis for further construction". However steelmaking industrial slag use has become possible only nowadays due to use of modern high effective technologies of profound complex recycling.

Nowadays they produce iron-bearing product for agglomerative production of high quality and ironless non-magnetic fraction for construction purposes at home steelmaking slag recycling enterprises.

Study of literature devoted to application of steelmaking slag in construction industries has shown that as a result of implemented recycling technologies slags can become an inexhaustible source of cheap raw such as fractionated rubble, sand and macadamized sandy mixtures for road construction as well as various construction materials, goods and stowing mixtures.

It has been established that main steelmaking slag use (speaking about electrometallurgical production) 20-25% as a component in coarse-grained ceramic masses promotes increase of strengthening, technical operational and aesthetic consumer properties of ceramic brick [3]. On basis of steelmaking slag of the JSC Oskolskiy electrometallurgical plant foamed concrete, with density 500 g /m<sup>3</sup> with durability 1,2 MPa [4], has been produced, composites and technologies of their production have been developed, application of which in road industries allows to increase operational terms and provides high transport operational road properties[5].

Creation of local industrial source of materials of large capacity steelmaking goods in Siberia will allow to get composite materials of different purposes by using innovative technologies.

## REFERENCES

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