UTILIZATION OF METALLURGICAL BY-PRODUCTS IN ECO-EFFICIENT CONCRETE MANUFACTURING.

Murodilova Mukhayyokhon Alisher qizi
Master's student of Fergana State Technical University
e-mail: yoldashevamuhayyo99@gmail.com
Tel: +998916627993
https://doi.org/10.5281/zenodo.15760832

Annotation: This article provides information on important factors in achieving economic efficiency and maintaining environmental stability by using the secondary resources generated by the activities of industrial enterprises in the production processes of building materials.

Keywords: Construction, enterprise, industrial waste, metallurgy, cement, construction materials, concrete types.

Introduction

During the sharpening of the relationship between man and the environment, and the rapid development of science and technology, conservation of nature is one of the most fundamental problems. It is a gratifying fact that science and innovation are developing at a rapid pace these days. In particular, today various types of concretes using metallurgical slag-based binders and fillers have been developed and are used in construction. The application of industrial waste in construction materials manufacturing processes ensures economic efficiency. Effective use of waste generated in the metallurgical industry is a factor in preserving the reserve source of our natural mineral resources. Currently, many metallurgical industry manufacturing companies are implementing waste-free technologies. It has been using new ways to melt ores without domna stoves. Also, the price of slag concrete products has decreased by 20...30% compared to usual.

Research materials and methodology

The annual amount of solid waste is increasing very quickly. Annual disposal of solid waste in the USA is 4.5 billion. reached tons. Including industrial waste - 1 bln. tons, and in other European countries - 7.2 billion tons, in Japan - 1.3 billion tons, including Russia and CIS countries - 100 million tons in 1990. tons, and in 2000 it exceeded 140-150 million tons.[1] According to experts, about 4 million tons of harmful substances are added to the atmosphere every year. "Half of these are carbon monoxide, 15% are hydrocarbon emissions, 14% are sulfur dioxide, 9% are nitrogen oxides, 8% are solids, and about 4% are specific acute toxic substances. it's worth it. As a result of the increase in the amount of carbon in the atmosphere, a unique large-scale greenhouse effect is created. As a result, the average temperature of the Earth's air will increase.[2] Taking these factors into account, extensive work is being carried out in all regions of our Republic, in the construction materials industry, and effective results are being achieved. Using secondary resources as a raw material base creates both economic and environmental efficiency.[3] In many cases, the secondary materials from the processing of natural deposits are not suitable fillers for concrete, but are used as raw materials for them.[4]

Pursuant to the decision of the President of the Republic of Uzbekistan "On additional measures to support housing construction and building materials industry" dated February 21, 2022 PQ-139, further development of the construction industry and the building materials complex priorities are defined. Based on this decision, building materials clusters will be established in 8 districts of the Republic, including Forish, and the production of building materials will be developed by organizing industrial cooperation with other regions." [5] "Solid wastes falling into the environment are divided into three categories:

1) Industrial, agricultural and municipal household waste. The main part of industrial waste is: mining and mining-chemistry (heaps, slag, etc.);

2) Black and non-ferrous metallurgy (slag, slag, dust, etc.); metal processing enterprises (slag, scrap, etc.);

3) Forestry and woodworking industry (woodworking waste, sawdust, small pieces, etc.),

4) Thermal power plants,

5) Energy industry (ash, slag, etc.),

6) Chemical and other types of industries (phosphogypsum, agarka, slags, slurries, broken glass, cement dust),

7) Organic production (rubber, platform, etc.),

8) Food (bone, wool, etc.),

9) Light textile and cotton cleaning industry (mineral and organic, dust, sludge, organic and mineral impurities after cleaning cotton, etc.)"[6]

Depending on the type of slag fillers, concretes of different average strength are made: very heavy (R_0 > 2500 kg/m^3) in some slags in steel production and in non-ferrous metallurgy: heavy (R_0 1800. ..2500 kg/m) in cast and tumbled slag limestone, sand and granular slag; coarse aggregate in light (R_0 < 1800 kg/m^2) slag pumice).

Coarse-grained slag concrete is used in parallel with fine-grained slag concrete, in which granulated slag is used as a filler. Depending on the structure, it is divided into ordinary dense, large-pored and porous slag concrete - porous slag concrete is considered very effective.

Slag concrete is divided into the following types according to its function: structural or general function: used in structural-heat-insulated, barrier structural applications; hydraulic engineer; road; heat insulation; acid and heat resistance. Slag concrete can harden under normal conditions, but their quality is greatly improved when treated with hot moisture (steaming and especially autoclaving).

Ordinary heavy concrete. By using a simple or slag binder together with a slag filler, all classes of heavy compressive concrete can be obtained. In this case, the strength of steamed concrete reaches 10...30 MPa, concrete hardened in an autoclave -30...60 MPa. In heavy concrete, instead of dense rock aggregate, slag crushed from strong metallurgical slag can be used, which does not reduce the strength of concrete, sometimes increases the strength of concrete.

The tensile strength of slag limestone concrete in bending is much higher than that of granite. Convenient placement of slag concrete depends on the water requirement of the filler of the concrete mixture. Slag limestone concrete is often coarser and harder to set than granite. The frost resistance of slag binding concrete and large dense filler is lower than ordinary cement concrete, that is, it is 50...100 cycles, only in slag binding concrete this indicator is much higher.

Stones of different sizes are used in the production of heavy concrete. Special grinders are used to grind large volumes of raw materials. Grinding intensifiers have been used in the construction industry for over 60 years.[7] Also, the use of cement grinding tools can improve the performance of ball mills, reduce specific energy consumption, and increase the fluidity of cement during transportation and processing.[8]

Lightweight concrete. Slag cement and filler are widely used in the production of lightweight concrete with an average density of 200...1600 kg/m^3 and a compressive strength of 5...25 MPa. Light slag concrete is characterized by general characteristics of lightweight concrete, i.e. Achieving maximum strength with minimal water consumption, as well as an increase in strength, a certain increase in binder consumption, etc. Light slag concretes with clinker-free slag binder are characterized by large deformations and teething with reinforcement, compared to portland cement concrete. Light filler for slag concrete is slag pumice, bulk density Po=500...800kg/m^3; granulated, blast furnace slag (R=700...1000), rolled, porous blast furnace slag (Ro 1000...800) are used.

The average density of lightweight concrete varies depending on the brand and type of filler. The structure of slag pumice and granulated blast furnace slag is characterized by the appearance of a glassy phase, which means that the thermal conductivity of slag concrete is lower than that of light concrete with fillers of a crystalline structure of the same average density (for example, quartzite, agloporite, etc.).

Slag pumice lightweight concretes have high axial tensile strength, high modulus of elasticity, similar to natural filler concretes obtained from volcanic eruptions. Slag-pumice concretes are extremely resistant to cold, this is a feature of slag-pumice composition, which creates a cement stone with low capillary porosity. Extreme cold resistance of slag pumice concrete ensures good deformation of the filler, suppresses a certain part of the internal pressure, creates a strong connection zone of slag pumice with the matrix (mixed part) of limestone. It is possible to obtain structural slag-pumice concrete for 600 cycles and more.

Aerated concrete differs from other types of artificial stone materials by having uniformly distributed pores in the form of cells with a diameter of 1..3 mm. Sergovak is producing concrete. when conventionally autoclaved, a slag binder is used, the hydraulic activity of which is manifested when the temperature and water vapor pressure rise. Such a binder is primarily a lime-slag binder obtained from granulated blast furnace slag.

Research results

The strength of aerated concrete made of slag materials varies depending on the average density. Heat-insulating aerated concrete R0=400...500 kg/m, compressive strength 0.6...2 MPa, structural heat-insulating concrete (R0=600-...1200)-3... 12.5.

The maximum strength of aerated concrete is 1:0.5...1:1.2 ratio of slag binder and silica components (depending on the nature of the raw material). The softness of slag materials also affects the strength of concrete. Therefore, when the specific surface of the slag binder increases from 3500 to 6500 cm^2/g, its strength increases by 50-60%. The strength and other properties are greatly improved when the water-solids ratio is reduced to 0.25...0.35, which is during the preparation and molding of the honeycomb mixture. the effect of vibration dilutes the mixture and increases the surface of interaction of raw

IBAST | Volume 5, Issue 06, June

material components, helps to accelerate the process of gas separation and hydration, at the same time increases strength by 25-30% and reduces shrinkage deformation by 15-25%.

Filler		Average density, t/m	
Slag pumice	0,9...1,3	1...1,35	1,1...1,4
Granulated blast furnace slag	1.3..1,6	1.4... 1.65	1,5...1,7
Overturned blast furnace slags	1,1...1,35	1,25...1,45	1,35... 1,55

Slag materials are widely used in the production of heat-resistant concrete as a filler, binder, crushed aggregate and hardener. Binders obtained on the basis of metallurgical slag surpass portlad cement in terms of heat resistance, which is explained by the extremely small amount of calcium hydroxide in the composition of slag cement stone. It is possible to obtain heat-resistant concrete suitable for use at temperatures up to 1200°C using slag portlad cement. A finely ground additive containing active krempezem and SaO is added to Portland cement concrete, exposed to action at 800-1000°C. Powdered blast furnace slag is used in such additional role in concretes with a maximum temperature of 700°C, together with ash generators and other siliceous materials. The degree of pulverization of slag must pass through a sieve of 70% of the weight of the test, the base of the module must not be more than 1. When slag portland cement is replaced by portland cement, the need to add finely crushed aggregate is determined by the size of the remaining strength of the concrete. If the strength of concrete is not lower than 40% when heated to 1700°C, it is possible not to add crushed aggregate. Slag materials are widely used in the production of heat-resistant concrete as a filler, binder, crushed aggregate and hardener. Binders obtained on the basis of metallurgical slag surpass portlad cement in terms of heat resistance, which is explained by the extremely small amount of calcium hydroxide in the composition of slag cement stone. It is possible to obtain heat-resistant concrete suitable for use at temperatures up to 1200°C using slag portland cement. A finely ground additive containing active krempezem and SaO is added to Portland cement concrete, exposed to action at 800-1000°C. Powdered blast furnace slag is used in such additional role in concretes with a maximum temperature of 700°C, together with ash generators and other siliceous materials. The degree of pulverization of slag must pass through a sieve of 70% of the weight of the test, the base of the module must not be more than 1. When slag portland cement is replaced by portland cement, the need to add finely crushed aggregate is determined by the size of the remaining strength of the concrete. If the strength of concrete is not lower than 40% when heated to 1700°C, it is possible not to add crushed aggregate.

Granulated and tumbled metallurgical slag, as well as slag pumice, can serve as a filler for heat-resistant concrete. The maximum working temperature of slag heat-resistant portland cement and slag portland cement concretes reaches 700-800°C. At extremely high temperatures, the strength of concrete decreases sharply due to the softening of glassy phases of slag fillers.

The quality of heat-resistant concrete is characterized by the following indicators: the compressive strength of heavy slag concrete reaches 30 MPa, it decreases by 2-2.5 times at 700-800°C. Also, another type of product obtained from industrial waste is gypsum is considered a carrier. "On the basis of construction gypsum, wall tiles, small-sized panels, large blocks of wedge and ridge type without mixing, plasterboard sheets, ventilation and architectural parts and other products are produced. Simple and complex plaster mixtures, scenic color and relief mixtures are prepared. High-strength gypsum has a compressive strength of 15-25 MPa, and it is used to make wall elements, prefabricated curtain wall panels, and architectural parts. Plaster gypsum is used in the preparation of molds for the production of ceramic and porcelain-faience products."[9]

Discussion

Compared to other lightweight concrete, cinder block concrete has a maximum tensile strength, which increases the strength of structures against cracking. Using alumina cement and slag pumice, the density of 410...1600 kg/m, the maximum temperature of 800°...1000°C is obtained. Heat-resistant concretes working at temperatures of 800...1700°C were obtained using binders and fillers obtained from steel alloy and iron alloy production slags. During the hardening process of such concretes, the active agents interact not only with the slag, but also with the fillers, first of all, with dust and clay particles, which do not dissolve like natural zeolite, and active hydroaluminosilicates are formed, which make the material thickens and increases its strength. With this, the demand for commercial concrete fillers will decrease significantly. In addition to traditional fillers (pebble, gravel, sand), many dispersion natural materials and products of various industries can be used for this purpose. Deformation properties of slag concrete and their engagement with reinforcement are similar to cement concrete with dense filler. This makes it possible to prepare steamed and autoclaved concretes with slag fillers for various industrial and residential reinforced concrete constructions.

Conclusion

Local soil and porous rock are widely used natural materials. fine sand, loamy and loamy soils, gravel-sand, soil-gravel mixtures cannot be used in the preparation of cement concrete due to their high dispersion and contamination. The mass of soil particles can be up to 5%, and dust particles - up to 20%. Filler containing gypsum grains and anhydrate cannot be used.

Various slags, ashes, TES-ash mixture, burnt rocks, wastes from stone crushing and stoning, as well as organic wastes of limestone, dispersed flora can be used to prepare heavy and light alkaline concrete from industrial waste.

References:

1. Mirziyoyev Sh.M. The Strategy of Development of New Uzbekistan. - Тошкент: Ўзбекистон. 2022.

2. Mirziyoyev Sh.M. Let's live freely and prosperously in New Uzbekistan. - Тошкент: Ўзбекистон. 2023y.

3. The Constitution of the Republic of Uzbekistan. Mukaddima. - Тошкент: Ўзбекистон. 2023
4. Мусулмонова О. Маънавий қадриятлар ва ёшлар тарбияси. Tashkent: Teacher. 1996.
5. Ergasheva O. N. Abdieva. "The Role of National, Spiritual, and Moral Values in Child Rearing." Prospects for the innovative development of pedagogical science in New Uzbekistan: theory and practice. - Тошкент: 2021.
6.Кенжаев Д.М. Исламские ценности в воззрение джадидов и их концепция духовного реформирования общества. Дисс. Кандидат исторических наук. – Тошкент, 2008.
7. Муртабаева А.Ж. Нравственные ценности народа и их значение в духовном возрождении Узбекистана. Дисс. кандидат философских наук. – Нукус, 2000.
8. Плеханова Л.М. Лингвостилистические особенности и семантико- функциональный характер лексем, выражающих гуманистические ценности. Дисс. кандидат филологических наук. – Ташкент, 1998.
9.Хусейнова А.А. Общечеловеческие ценности в мировозрении Абдурахмана Джами. дис. канд.филос.наук: Ташкент, 1994.
10. Аксакалова Ж.К. Психологический тренинг как фактор развития ценности семьи. Дисс. … канд. Психол. наук. – Ташкент, 2008.
11. Романюк А.А. Исторические и культурные ценности как объекты гражданско-правовых отношений. Автореферат. канд. юр. наук. – Ташкент, 2015.
12. Tulenov Zh. Philosophy of Values. - Тошкент: Ўзбекистон. 1996. The works of the scientists are presented in the section "List of used literature" of the dissertation.
13. A.A. Kambarov. A socio-philosophical analysis of the transformation of scientific and religious values in Uzbekistan. - Andijan: 2023.