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TECHNOLOGY FOR OBTAINING REDUCED IRON FROM PYRITE CINDERS

Eshonkulov U.Kh., Senior Lecturer, Department of Mining.
Karshi Institute of Engineering and Economics.
Karshi, Republic of Uzbekistan.
Turdiev Zh.N., Student of the Karshi Institute of Engineering and Economics

ABSTRACT: Chemically pure iron is a shiny silvery-white viscous and malleable metal with a density of 7.8 g/cm3 and a melting point of 1539±1 °C. The most common are iron-carbon alloys (cast iron, steel), iron-manganese alloys (ferromanganese), silicon (ferrosilicon), chromium (ferrochrome), tungsten, vanadium, titanium, niobium, cobalt, nickel, molybdenum, etc. playing a leading role in modern technology

ABSTRACT: Iron in its chemically pure form is a shiny silvery-white viscous and malleable metal with a density of 7.8 g/cm3 and a melting point of 1539±1 °C. Forms alloys with many elements. The most common are iron-carbon alloys (cast iron, steel), iron alloys with manganese (ferromanganese), silicon (ferrosilicon), chromium (ferrochrome), tungsten, vanadium, titanium, niobium, cobalt, nickel, molybdenum, etc., which play a leading role in modern technology

Due to the inclination of the furnace and its rotation, the charge (pyrite cinder + solid reducing agent) moves from the charging end of the furnace to the hot head towards the hot gases, which transfer heat to the lining and surface of the charge [5]. At the same time, the charge undergoes a number of physical and chemical transformations: heating, reduction, melting, etc.

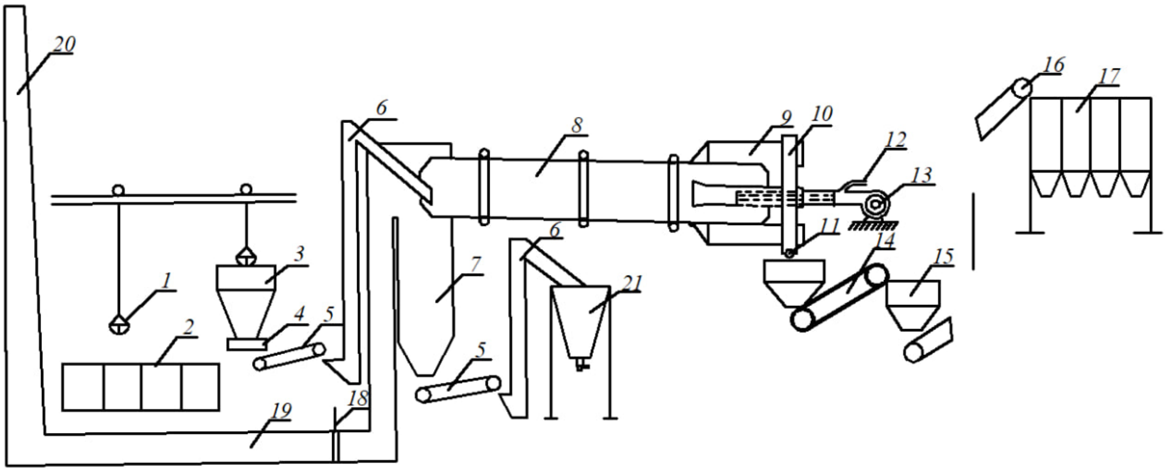
According to the theory of G.I. Chufarov [6], the mechanism of the process of reduction of iron oxides has an adsorption-autocatalytic character and is carried out in three consecutive stages:

(I) Adsorption of reducing agent gas on the oxide surface:
2) Surface reaction of the adsorbed reducing agent with oxygen.
3) desorption of gaseous reaction products.

Iron oxides are reduced in stages: from the highest to the lowest, up to the formation of metallic iron, according to the scheme:

$$\mathrm{Fe2O3} \rightarrow \mathrm{Fe3O4} \rightarrow \mathrm{FeO} \rightarrow \mathrm{FeO}$$

The reduction of iron is carried out mainly by carbon monoxide, partly by solid carbon and hydrogen. Iron from pyrite cinders is more difficult to recover than from iron ores, because pyrite cinders are a product of thermal processing [4] Description of the technological scheme.



Rice. 1. Diagram of technological equipment for the production of sponge iron. 1. Grab crane. 2. Charge yard. 3. Feed hopper. 4. Disc feeder. 5. Conveyor. 6. Elevator. 7. Dust hopper. 8. Bake. 9. Refrigerators. 10. Collector ring. 11. Unloading. 12. Gas pipeline. 13. VSD-8 fan. 14. Bucket conveyor. 15. Bunker. 16. Transporter. 17. Finished product hoppers. 18. Shiber. 19. Underground gas duct. 20. Gas exhaust pipe.

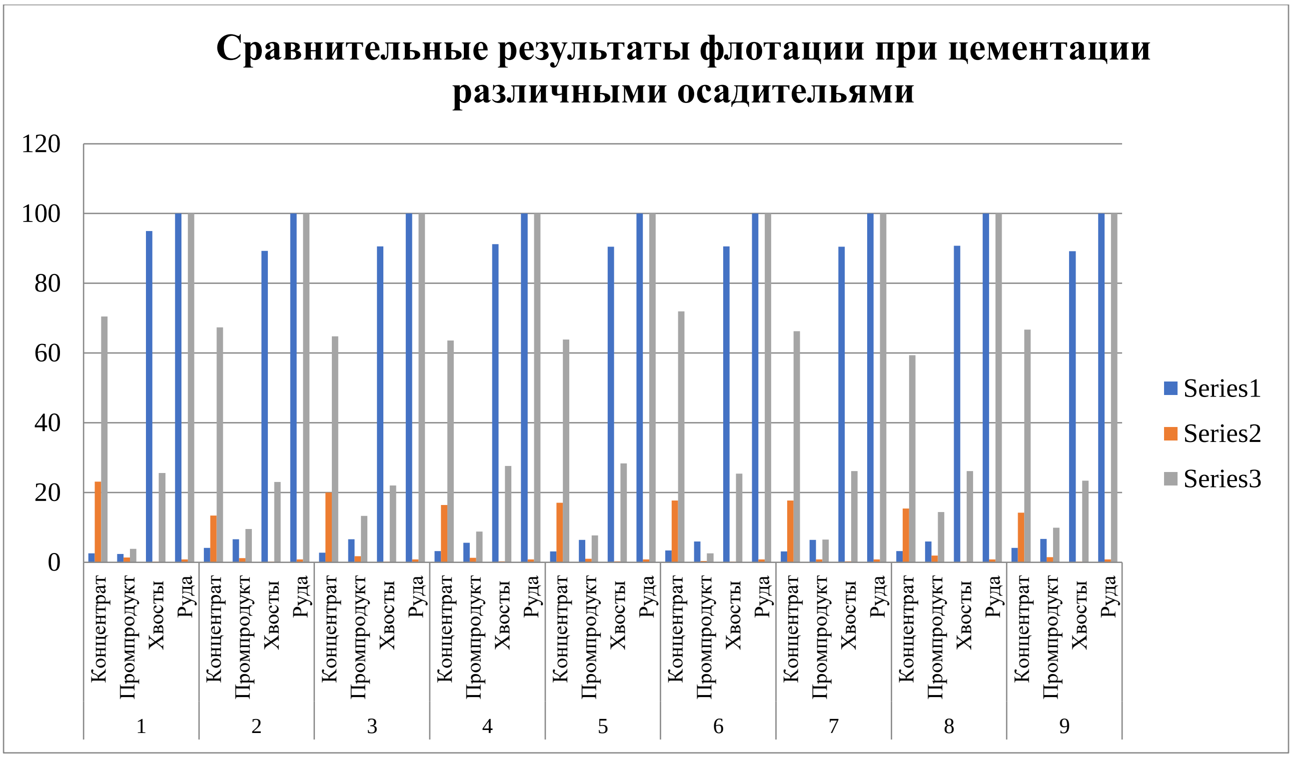
Pyrite cinders and reducing agent (coke and coal) from (Fig. 1) of the corresponding compartments of the charge yard (2) were fed by a grab crane (1) into a special compartment for blending. The bucket of the grab crane was pre-calibrated for cinder, coke and coal. The specified composition of the charge for each experiment was made by volume ratio or by the number of grab crane roots. Cinders and reducing agent (coke and coal) were alternately poured into the charge compartment in layers. After that, they were thoroughly mixed with a grab crane.

The batch prepared in this way was fed into the feed hopper (3) The amount of charge fed into the furnace was regulated by a disc feeder (4), the productivity of which was lost 2 times per shift. Further, the charge was fed through the conveyor belt (5) and the elevator (6) to the heating furnace (8).

The resulting reduced product (sponge iron) was discharged into refrigerators (9) with external water spraying, and through a sealed ring (1O), a gate (11) and a system of conveyors (14) (16) entered the finished product hopper (17).

The dust deposited in the dust chamber (7) was transported to the dust hopper (21). Gas from the rotary kiln was emitted into the atmosphere through a dust chamber, an underground gas duct (19) and a pipe (20) (50 m high).

The recovered cinder after magnetic separation was tested by the MOF-1 enrichment laboratory as a copper precipitator from a sulfuric acid solution. The solution contained 5 g/l of copper and 2 g/l of free sulfuric acid. Copper precipitation was carried out both with uncrushed cinder and crushed to a size of 0.3 mm. Grinding of cinders made it possible to reduce the carburizing time from 10 to 3-5 minutes.



Rice. 2. Comparative Flotation Results in Carburizing with Different Precipitators

Cementation was carried out at t:x=1:2. Table 3.22 shows the comparative results of flotation with spilled precipitators.

Fig. 2 shows that cinders are a satisfactory copper precipitator in the processing of oxidized ores by a combined process.

As can be seen from Table 11, the copper that is introduced with the precipitator into the carburization process is quite fully recovered during flotation.

Extraction of copper from the non-magnetic fraction of cinders and dust is difficult, and the enrichment laboratories have submitted these samples to find the possibility of extracting copper.

1. On the basis of the work carried out, a method for obtaining an active iron precipitator by reducing roasting in a fluidized bed of iron concentrate obtained at MOF-1 during soap flotation of oxidized ores of Almalyk is proposed.
2. The recovery charge consists of 20% coxa (weighted average diameter 0.7 mm), 1 mm fine, and 80% concentrate 0.5 mm fine (weighted average diameter 0.153 mm).
3. The following firing mode has been developed: temperature 940-9500, blast speed 19-20 cm/sec. The reduced converted gas should contain no more than 1-1.5% of carbon dioxide, not less than 16-18% of carbon monoxide and 30-35% of hydrogen.
4. The yield of cinder is 65-70%, dust -35-30%; The yield of the magnetic fraction is 35-40% of the firing products. Recovery rate – 80-90%; The content of metallic iron in the magnetic fraction of cinder is 55-65%, in dust - 35-40%.

5. The concentrate capacity is 7.8 t/m2 per day, and the active iron powder capacity is 3.2 t/m2 per day.

At the same time, the consumption of natural gas amounted to 1060 Nm3 per 1 ton of active powder. With an increase in productivity by 1.5-2 times, which is possible due to an increase in the height of the fluidized bed to 1000-1500 mm, the specific consumption will decrease to 600-700 Nm3/t.

6. The size of the resulting cinder at a constant process temperature can be controlled by the productivity of the process: at a higher capacity, a finer powder with a comparatively reduced content of active iron (50-55%) is obtained.
7. The recovery of copper into the magnetic fraction of reduction products is 45-55%. This copper is extracted by cementation with iron powder, into which this copper is transferred.
8. Reduction products: cinders and dust (magnetic fraction) are satisfactory precipitators of copper from sulphuric acid solutions.

It is necessary to continue research on the extraction of copper from non-magnetic fractions of cinders and dust

References.

1. Khakimov, K. Zh., Kayumov, O. A. U., Eshonkulov, U. H. U., & Soatov, B. S. U. (2020). TECHNOGENIC WASTES ARE A PROMISING RAW MATERIAL FOR METALLURGY OF UZBEKISTAN IN THE ASSESSMENT OF DUMP TAILINGS OF FILTRATION OF COPPER-MOLYBDENUM ORES. *Universum: Technical Sciences*, (12-1 (81)), 54-59.
2. Eshonkulov, U. K. O. G. L., Shukurov, A. Y., Kayumov, O. A. O. G. L., & Umirzoqov, A. A. (2021). STUDY OF THE MATERIAL COMPOSITION OF TITANIUM-MAGNETIC ORE OF THE TEBINBULAK DEPOSIT. Scientific progress, 2(7), 423-428.
3. Эшонкулов, У. Х. У. (2022). ХАРАКТЕРИСТИКА И ТИПЫ ЖЕЛЕЗНЫХ СЫРЁ. *ONLINE SCIENTIFIC JOURNAL OF SUSTAINABILITY AND LEADING RESEARCH*, *2*(11), 303-308.
4. Хакимов, К. Ж., Эшонқулов, У. Х., & Умирзоқов, А. (2020). Complex Processing Of Lead-Containing Technogenic Waste From Mining And Metallurgical Industries In The Urals. *THE AMERICAN JOURNAL OF ENGINEERING AND TECHNOLOGY (TAJET) SJIF-5.32 DOI-10.37547/tajet*, *2*(9), 2689-0984.
5. Хасанов, А. С., Хакимов, К. Ж., Шодиев, А. Н., & Эшонкулов, У. Х. (2018). Уран и Золото. *Мухофаза+ Ижтимиойсийосий, илмий-амалий ва бадиий журнал*, (01 (157)), 13.
6. Khasanov, A. S., Eshonkulov, U. Kh., & Kayumov, O. A. (2023). INVESTIGATION AND DETERMINATION OF TECHNOLOGICAL PARAMETERS OF IRON EXTRACTION FROM IRON-CONTAINING RAW MATERIALS AND ORES. *BARQARORLIK VA YETAKCHI TADQIQOTLAR ONLAYN ILMIY JURNALI*, *3*(4), 291-298.
7. Khasanov, A. S., & Eshonkulov, U. Kh. (2023). PREPARATION OF INITIAL IRON-CONTAINING RAW MATERIALS FOR PROCESSING AND LABORATORY TESTS FOR RECOVERY. *ARXITEKTURA, MUHANDISLIK VA ZAMONAVIY TEXNOLOGIYALAR JURNALI*, *2*(4), 34-46.

8. Eshonqulov, U. K. O. G. L., Umirzoqov, A. A., Khodjakulov, A. M., & Quziyev, H. J. (2021). DEVELOPMENT OF A TECHNOLOGICAL SCHEME OF SAMPLE ENRICHMENT TITANIUM-MAGNETIC ORE OF THE TEBINBULAK DEPOSIT. *Scientific progress*, *2*(7), 407-413.
9. Eshenkolivo, U.S.A., & T. N. (2023). *JOURNAL OF ARCHITECTURE, ENGINEERING AND MODERN TECHNOLOGIES*, *2*(1), 32-36.
10. Eshonkulov, U. Kh., Khasanov, A. S., & Khuzhakulov, A. M. (2022). NEW METHODS OF CONCENTRATE ENRICHMENT AND PROCESSES FOR THE PREPARATION OF IRON-BEARING ORES. In *Scientific Foundations and Practice of Processing of Ores and Technogenic Raw Materials* (pp. 119-125).
11. Abdurashid Khasanov, & Uchkun Eshonkulov. (2023). STUDY OF METHODS OF IRON SEPARATION FROM IRON-CONTAINING RAW MATERIALS. *Best Journal of Innovation in Science, Research and Development*, *2*(11), 119–123. Retrieved from https://www.bjisrd.com/index.php/bjisrd/article/view/818
12. Kayumov, O. A. U., Khakimov, K. Zh., Eshonkulov, U. H. U., Boymurodov, N. A., & Norkulov, N. M. U. (2021). Study of the chemical, granulometric and phase composition of gold-bearing mixed ores. *Universum: Technical Sciences*, (3-3 (84)), 45-49.
13. Son of Hudaynazar, E. U., Kudraratullayevna, K. S., Tashtemirovich, B. B., son of Almighty, H. D. (2023). CHECK THE CEMENTING PROPERTIES OF THE RESTORED BURN MAGNETIC FRACTION. *ONLINE SCIENTIFIC JOURNAL OF SUSTAINABILITY AND LEADING RESEARCH*, *3*(11), 1-7.
14. Son of Hudaynazar, E. U., Kudraratullayevna, K. S., Tashtemirovich, B. B., son of Almighty, H. D. (2023). STUDYING THE COMPOSITION OF IRON-CONTAINING RAW MATERIALS AND HOW TO DISTINGUISH IRON FROM THEM. *JOURNAL OF ARCHITECTURE, ENGINEERING AND MODERN TECHNOLOGIES*, *2*(10), 29-37.
15. Turdiev, S. Sh., & Eshonkulov, U. Kh. (2023). STUDY OF CHEMICAL COMPOSITIONS OF ZINC WASTE AND PROCESSING TECHNOLOGY. *Science and Technology in the Modern World*, *2*(18), 28-32.
16. Shodiyev, A., Turobov, S., Abdullayev, Z., & Sarkisiankulov, U.S. (2023). IN THE TRADITIONAL NICKEL MELTING PROCESS, THE LOW-LEVEL NICKEL STEIN IS CONVERTED INTO A HIGH-QUALITY NICKEL STEIN BY MEANS OF HIGH-TEMPERATURE DISSOLVING TO OXIDIZE THE IRON AND REMOVE IT AS SILICATE SLURRIES. *In secular history*, *2*(18), 39-42.
17. Turdiev, S. Sh., & Eshonkulov, U. Kh. (2023). CHEMICAL COMPOSITION OF THE ORES OF THE KALMAKYR DEPOSIT. *Science and Technology in the Modern World*, *2*(18), 33-38.
18. Turdiev, S. Sh., & Eshonkulov, U. Kh. (2023). METHODS FOR PURIFICATION OF PLATINUM CONCENTRATES AND ANALYSIS OF THE RESULTING PURE METALS. *Science and Technology in the Modern World*, *2*(18), 23-27.
19. Turdiev, S. Sh., & Eshonkulov, U. Kh. (2023). DEVELOPMENT OF TECHNOLOGY FOR PROCESSING FERROUS AND PRECIOUS METAL CONCENTRATES OBTAINED FROM TAILINGS OF MOF-1 AND MOF-2 WITH COMPLEX

EXTRACTION OF PRECIOUS METALS. *Science and Technology in the Modern World*, *2*(18), 43-47.

20. Kathmandulov, U.S.A., (2023). RESEARCH AND IDENTIFICATION OF TECHNOLOGICAL DIMENSIONS OF THE EXTRACTION OF IRON FROM RAW MATERIALS AND ORES CONTAINING IRON. *Digital technologies/digital technologies in the industry*, *1*(2), 64-69.
21. Eshonkulov, U. Kh., Kayumov, O. A., & Khakimov, K. Zh. (2022). Study of the technology of direct reduction of iron. *Central Asian Journal of Theoretical and Applied Science*, *3*(11), 151-156.
22. Kathmandulov, U.S.A., (2023). RESEARCH AND IDENTIFICATION OF TECHNOLOGICAL DIMENSIONS OF THE EXTRACTION OF IRON FROM RAW MATERIALS AND ORES CONTAINING IRON. *Digital technologies in the industry*, *2*(01).