



## ANALYSIS OF MULTI-STAGE APPROACHES TO THE TECHNOLOGY OF IRON ORE EXTRACTION AND PROCESSING IN THE TEBIN BULAK MINE

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<https://www.doi.org/10.5281/zenodo.8262951>

### ARTICLE INFO

Received: 11<sup>th</sup> August 2023

Accepted: 17<sup>th</sup> August 2023

Online: 18<sup>th</sup> August 2023

### KEY WORDS

*Titanium-magnetite ores, rock crushing, technological schemes of ore processing, iron ore concentrate, mining processes, magnetic separation, blasting processes, detonators, open pit mining.*

### ABSTRACT

*The Tebin Bulak iron ore mining enterprise of the Republic of Karakalpakstan is planned to have a large production capacity. The technology for improving the quality of the titanium-magnetite concentrate extracted from the massif is proposed, which consists of separate grinding of the ore into two technological grades - high-quality content and average content, and concentration of the grades in separate sections. Thanks to this proposed technological scheme, it will be possible to ensure that the ore is divided into easily concentrated and hard concentrated grades at the concentration stage, but it is important in the stages of mining, transportation and preparation for crushing of iron ores. The advantage of the new technology currently used in mines is the relative complexity of equipment modernization, since the technological scheme of ore processing is changed only in the concentration plant. The percentage of titanium-magnetite in the mine is 16-33 percent. Blasting processes are currently being carried out at the Tebin Bulak mine.*

Employees of the Nukus Mining Institute of the Navoi State Mining and Technology University at the Tebin bulak iron ore mine Djaksimuratov.K., Otelbayev.A., Jumabayeva.G., Karamov.A., Allanazarov.B. Witnessed the first blasting of the mine. Tebin Bulak mine, the largest iron ore mine in Uzbekistan, can be considered as the most important source of raw materials for the country's metallurgical industry. Projected reserves of various grades of iron ore are estimated at 3.5 million tons, with an average grade of 16.2% iron and 0.15% vanadium pentoxide. Overall, titanomagnetite ore reserves are estimated to be approximately 2.5 billion tonnes for the whole deposit and 1.0 billion tonnes for the West Zone. Appropriate favorable conditions should be taken into account: open work, proximity to rail and road transport and high-voltage power lines, and the availability of a large labor pool should be considered. According to the composition of iron minerals, ores can be divided into massive, large-sized rocks and medium-sized rocks. It can be seen that all ores are complex and contain iron ores. There are two main methods of processing iron ore titanomagnetites -

hydrometallurgical and pyrometallurgical. Tebin Bulak mine is one of the largest iron ore mining enterprises in the Republic of Karakalpakstan. Ores and concentrates with relatively high vanadium oxides can be processed by the former method. However, a feasibility study of its effectiveness shows that processing concentrates containing no more than 1.0% is not feasible, as it requires the use of more reagents, significantly greater capital investment, and as a result operating costs will be high. During reductive smelting of iron ore concentrate in blast furnaces, almost all of the vanadium in the concentrate is transferred to pig iron. During the subsequent oxidative blasting of the cast iron in the converter, vanadium containing 10-30% is usually transferred. Vanadium processing involves oxidative calcination with the addition of potassium, sodium, and calcium oxides, leaching of vanadium in solution, and subsequent recovery by hydrolysis. This method initially produces 15-20% of iron ore in the concentrate, and alloying steels with ferrovanium reduces this figure to 20%. Several economic and technological factors make the establishment of large-scale metallurgical operations (including blast furnaces) at the site of the mine an undesirable course of action. For this situation, metallurgical technology that does not involve the use of coke looks more promising. New schemes for improving the quality of concentrates are primarily characterized by separate mining in open pits and separate processing of natural types of ores in a processing plant. Such technology can be used in the conditions of the Tebin Bulak mining and processing plant, where mainly high-iron ores and low-titanium ores and mainly low-vanadium and high-titanium ores are mined in separate streams, which are transported separately for processing. In the processing plant, these streams are processed in separate sections. Ore processing technology should be tested in laboratory conditions at Tebin Bulak Metals Mining Department. Using the technology, a simple concentrate (30% Fe) and a high-quality concentrate (Fe) for metallization were obtained.



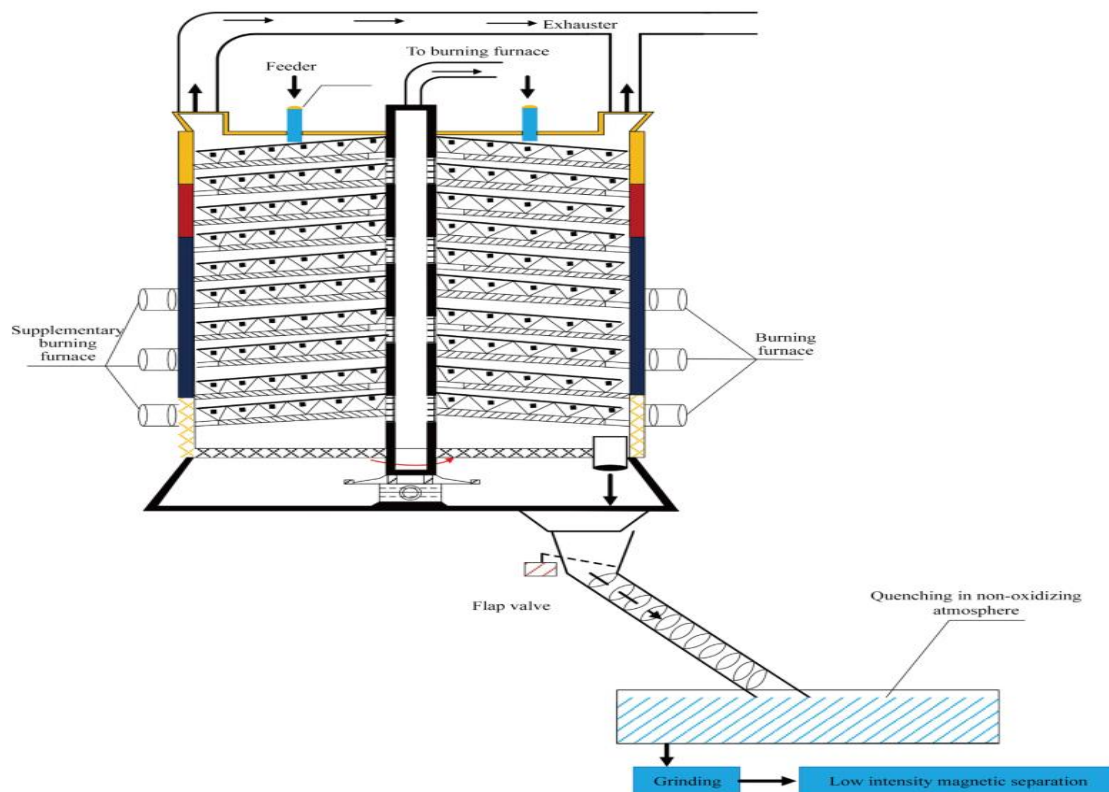
**Picture1. 521 detonators were detonated during the first blasting operations at the Tebin Bulak mine.**

- a) the metallized product could be obtained from massive titanomagnetite ores that originally contained more than 30% iron and could be processed without additional concentration.
- b) the metallized product could be obtained not only in expensive shaft furnaces and in modules designed for solid-phase reduction of ferro-coal.

Thus, the final decision on the feasibility of developing the Tebin Bulak mine will still depend on additional research on the technologies to be developed and the equipment to be selected for their implementation. Such studies require: Determining the goals of Tebinbulok



titanomagnetite processing: mining of iron ores themselves or systematic processing that produces iron, vanadium and titanium; it will be necessary to determine the exact volume of processing operations. It will be necessary to carry out additional scientific research on the development of ore processing technology and the improvement of the beneficiation method. It is necessary to ensure the technical and economic substantiation of the mine processing scheme and the selection of equipment for its implementation. It is necessary to improve the selected technology steps for iron ore processing. Commercial implementation of the chosen scheme for processing Tebin bulak titanomagnetites. The implementation of the pyrometallurgical technology of Tebinbulok titanomagnetite processing allows partial or complete abandonment of scrap metal, providing the Republic of Uzbekistan with the necessary steel, and leaving the excess steel for export to neighboring countries. Work on the implementation of the above technology may begin in the near future. For this to happen, three conditions must be met: the mine must be found to contain iron-rich ore; equipment for metallization of iron ore must be available (existing furnaces can be used for this purpose after modification); The electric steel foundry at the Metallurgical Plant of Uzbekistan (in the city of Bekobod) should be able to convert the metallized product into natural alloy steel. A key conclusion from this financial evaluation is that highly energy-efficient autogenous processing routes with multiple separation steps provide significant financial benefits for fine-grained hard magnetite ores. For the ore type evaluated, the use of HPGR and hybrid milling technology has been shown to reduce energy consumption by up to 25 percent compared to conventional flow plates with wet milling. Flowsheet design and option selection must be tailored to the magnetite ore crushing and separation characteristics. For fine-grained ores, the addition of a third grinding stage, which uses energy-efficient mixed milling, benefits the economy in two ways: reducing the amount of material that must be finely ground and grinding with high energy efficiency. The use of technology significantly reduces energy consumption compared to milling. The 'synergy' of and primary gravel milling proposed in could result in a very efficient scheme from both a capital and operational perspective. medium for secondary gravel milling scheme (stones). The product from the primary gravel mill is much finer than what can be practically obtained from the closed circuit, and therefore the tailings rejection is higher, significantly reducing the task of the subsequent gravel milling step. In general, the magnetite market and the required volume of magnetite concentration are expanding rapidly, and as a result, metallurgical research and process design are becoming more important and important. To this end, a well-structured and planned learning and evaluation period is essential if the goal is to maximize project life-cycle value and minimize financial and stakeholder risk.



Picture.2 Separator processes approach to extracting titanium-magnetite. Magnetic separation

This roasting technology is an efficient and fast magnetic reduction system for all types of refractory oxidized iron ores with weak magnetism. Magnetic roasting reaction in iron ore reducing gas is a typical gas-solid two-phase reaction. The reaction process consists of the following steps: Mass transfer of reducing gas and products between host gas and iron ore surface is often described as external diffusion. Internal diffusion of reducing gas and gas products occurs through the renewable magnetite layer. Hexagonal lattice hematite in the cubic system transforms into cubic lattice magnetite in the equiaxial system, which is the driving mechanism for complex cryptocrystalline oolitic hematite. The interfacial chemical reaction between gas reactant and hematite (solid) includes adsorption of reactant on solid surface, chemical reaction between gas reactant and solid, gas product desorption, nucleation and growth. of the solid product, magnetite.

**Conclusion**

A technology for improving the quality of titanomagnetite concentrate was proposed, which consists in dividing the ore or intermediate product into two technological grades, "high-quality" and "medium-quality" ores according to the beneficiation scheme, and then separately crushing and beneficiating these grades separately. there will also be opportunities for implementation. According to such a technological scheme, ore is divided into easy-rich and difficult-to-process varieties, not at the stages of technological preparation for extraction, transportation and crushing, but at the enrichment stage. The advantage of the modernized technology is the relative simplicity of production, since the technological scheme of ore processing changes only in the concentration plant. For comparison, the mass fraction of iron



in iron ore concentrates produced by current mining and blasting methods of the Tebin Bulak mine depends.

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