

INNOVATION IN METALLURGICAL
INDUSTRIAL AND LABORATORY EQUIPMENT,
TECHNOLOGIES AND MATERIALSИННОВАЦИИ В МЕТАЛЛУРГИЧЕСКОМ
ПРОМЫШЛЕННОМ И ЛАБОРАТОРНОМ
ОБОРУДОВАНИИ, ТЕХНОЛОГИЯХ И МАТЕРИАЛАХ

UDC 669.187

DOI 10.17073/0368-0797-2024-6-735-737



Short report

Краткое сообщение

RE-ENGINEERING OF BALL MILL AT NOVOTROITSK PLANT OF CHROMIUM COMPOUNDS

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Abstract. Novotroitsk Plant of Chromium Compounds (NPCC) specializes in the processing of chromite and dolomite ores. Operating experience showed that the loss of operability of the ball mill installed in this workshop leads to unplanned downtime due to the failure of drive elements, which account for 11.3 % of the rated operating time of the workshop. To improve the reliability of technological equipment, it was proposed to replace the existing electric drive with a modern geared motor, which transmits rotation to the mill drum through a gear coupling. As a result of the new drive engineering, it was possible to simplify its design and reduce the labor intensity of maintenance and repair. Additional capital expenditures do not exceed RUB 3.4 million and pay off in less than 3 months.

Keywords: foundry, beneficiation production, crushing and grinding processes, tube ball mill, electromechanical drive, geared motor

For citation: Nefedov A.V., Ishmukhametov R.E., Chichenev N.A. Re-engineering of ball mill at Novotroitsk Plant of Chromium Compounds. *Izvestiya. Ferrous Metallurgy*. 2024;67(6):735–737. <https://doi.org/10.17073/0368-0797-2024-6-735-737>

РЕИНЖИНИРИНГ ШАРОВОЙ МЕЛЬНИЦЫ НОВОТРОИЦКОГО ЗАВОДА ХРОМОВЫХ СОЕДИНЕНИЙ

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Аннотация. Новотроицкий завод хромовых соединений специализируется на переработке хромитовых и доломитовых руд. Опыт эксплуатации показал, что потеря работоспособности шаровой мельницы, установленной в данном цехе, приводит к незапланированным простоям из-за отказа элементов привода, которые составляют 11,3 % от номинального времени работы цеха. Для повышения надежности технологического оборудования предложена замена действующего электропривода на современный мотор-редуктор, передающий вращение барабану мельницы через зубчатую муфту. В результате разработки нового привода удалось упростить его конструкцию и уменьшить трудоемкость технического обслуживания и ремонта. Дополнительные капитальные затраты не превышают 3,4 млн руб и окупаются менее, чем за три месяца.

Ключевые слова: обогащательное производство, процессы дробления и измельчения, трубчатая шаровая мельница, электромеханический привод, мотор-редуктор

Для цитирования: Нефедов А.В., Ишмухаметов Р.Э., Чиченев Н.А. Реинжиниринг шаровой мельницы Новотроицкого завода хромовых соединений. *Известия вузов. Черная металлургия*. 2024;67(6):735–737. <https://doi.org/10.17073/0368-0797-2024-6-735-737>

Modern metallurgical enterprises place significant emphasis on re-engineering existing equipment [1 – 3]. This includes the introduction of advanced technologies, automation of metallurgical process management using modern computer systems, improvements in labor organization, and enhancement of personnel qualifications [4 – 6].

Novotroitsk Plant of Chromium Compounds (NPCC) specializes in the processing of chromite ore. After the initial crushing of large pieces, the ore is transported via conveyor to a dry grinding mill, where chromite and dolomite ores are ground. From the ball mill, the material is conveyed to the next elevator and, finally, to a hopper in the batch preparation area.

Currently, the grinding section operates a ball mill model SMM2061, equipped with a 4A series electric motor, which is now discontinued, and a special gearbox. Physical and functional obsolescence results in unplanned downtime due to failures in the drive components, which account for 11.3 % of the nominal operating time of the workshop.

With the growing demand for NPCC products, it has become necessary to increase the productivity of technological equipment, including enhancing the power of the electric drive and the drum rotation speed of the ball mill. Operational experience with ball mills indicates that productivity increases (without altering the drum design) are possible within a range of 10 – 15 %. This technical solution will allow NPCC, a chemical-metallurgical company, to increase the production of sodium monochromate by processing a larger volume of chromite and dolomite ores in the first shop's crushing section, thereby reducing production costs.

To achieve this, a replacement of the existing electric drive with a modern R167DV280V4/BVG122 geared motor with a power of 30 kW and a low-speed shaft rotation frequency of 22 rpm has been proposed. The drive is mounted on a welded sheet metal frame. A general-purpose gear coupling is used to connect the transmission shaft between the output shaft of the geared motor and the mill's drive shaft.

To assess the economic efficiency of implementing the upgraded drive for the tube ball mill, a capital cost estimate was prepared. The total investment required, including the cost of purchasing and installing the new equipment, amounts to approximately RUB 3.4 million. The expected economic effect of implementing the new drive is associated with a reduction in the time required for capital and routine repairs, leading to an increase in the ball mill's productivity by 3 t/h. The proposed modernization of the drive will reduce the cost of processing 1 ton of ore by 0.02 %, increase production profitability by 1.37 %, and boost sales profit by 1.29 %. At the current production volume, this will result in a significant economic benefit. The costs of implementing the proposed equipment will be recouped in less than three months

from the start of its operation. These indicators demonstrate the economic efficiency of the developed project.

CONCLUSIONS

As a result of the modernization of the tube ball mill drive, its design was simplified, and the labor intensity of maintenance and repair was reduced. Replacing the old drive, which included an electric motor and a gearbox, with a new drive consisting of a geared motor and a gear coupling, allows for an extended maintenance interval, thereby reducing operational costs. Calculations show that the implementation of the proposed design solutions leads to a 0.02 % reduction in the cost of processing 1 ton of ore, a 1.37 % increase in production profitability, and a 1.29 % increase in sales profit. Additional capital expenditures do not exceed RUB 3.4 million and are recouped in less than three months.

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Вклад авторов

A. V. Nefedov – formulation of the article idea, definition of the purpose and objectives of the research.

R. E. Ishmukhametov – analysis and generalization of the results.

N. A. Chichenev – search and analysis of publications, formation of the article concept, writing the text.

А. В. Нефедов – формулировка идеи работы, определение цели и задачи исследования.

Р. Э. Ишмухаметов – анализ и обобщение полученных результатов.

Н. А. Чиченев – поиск и анализ литературных источников, формирование концепции статьи, подготовка текста.

Received 13.07.2024

Revised 18.07.2024

Accepted 23.10.2024

Поступила в редакцию 13.07.2024

После доработки 18.07.2024

Принята к публикации 23.10.2024