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On the Contribution of Professor Vladimir Andreevich Mozharov to the Development of Metallurgy in the 20th Century

Abstract

The article presents the research results of the scientific and pedagogical activities of an outstanding metallurgist of the first half of the 20th century, Professor Vladimir Andreevich Mozharov. The scientist's formative years and motives for his interest in metallurgy are discussed.

Based on archival data, it was found that the active production activity of Vladimir Andreevich Mozharov began after his graduation from the St. Petersburg Mining Institute in 1907.

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Since the end of 1916, Mozharov headed the Nikolaev Metallurgical Plants in Irkutsk. From March 1920 to the beginning of 1922, Mozharov worked at the Irkutsk Council of National Economy.

In the years 1922–1925, Mozharov served as deputy chairman of the Irkutsk Provincial Executive Committee and the Planning Commission. Due to a serious illness of the eldest son, the family was forced to move to Kharkov.

In November 1925, Vladimir Andreevich Mozharov became the Chief Metallurgist of the Board of the Southern Machine-Building Trust. From the end of 1929, Vladimir Andreevich worked at the Kharkov Institute of Metals as head of the steelmaking group, head of the department of heat power engineering of metallurgical processes, and then deputy director for scientific work. The most famous work carried out under the leadership of Vladimir Andreevich Mozharov in the 1930s was the development of the technology for producing ARMCO iron and Toncan technical iron.

During the evacuation in 1941–1943, works under the leadership of Vladimir Andreevich Mozharov were carried out to intensify melting and pressure processing of steel ingots, to replace Ukrainian iron ores with Ural and Kuznetsk ones, and to use technology for producing ferroalloys from local ores. After returning to Kharkov, the scientist led the restoration of Ukraine's Institute of Metals and metallurgical enterprises destroyed by the war. Vladimir Andreevich Mozharov passed away at the end of 1952.

The article analyzes some interesting, forgotten and little-known facts of the biography of the outstanding metallurgist, scientist and teacher Vladimir Andreevich Mozharov, which are an integral and important part of the history of metallurgy of the 20th century.

Keywords: *Ural, Irkutsk, Kharkov, UkrNIIMet, Mozharov, gas generators, steel, cast iron, open-hearth furnace, metallurgy, ARMCO iron, Toncan iron*

O wkładzie profesora Władimira Andriejewicza Możarowa w rozwój metalurgii w XX wieku

Abstrakt

W artykule przedstawiono wyniki badań naukowych i działań dydaktycznych wybitnego metalurga pierwszej połowy XX wieku, profesora Władimira Andriejewicza Możarowa.

Omówiono lata dorastania naukowca oraz motywy jego zainteresowania metalurgią. Na podstawie danych archiwalnych ustalono, że aktywna działalność zawodowa Władimira Andriejewicza Możarowa rozpoczęła się po ukończeniu Petersburskiego Instytutu Górniczego w 1907 roku.

Od końca 1916 roku Możarow kierował Nikołajewskimi Zakładami Metalurgicznymi w Irkucku. Od marca 1920 do początku 1922 pracował w Irkuckiej Radzie Gospodarki Narodowej. W latach 1922–1925 pełnił funkcję wiceprzewodniczącego Irkuckiego Gubernialnego Komitetu Wykonawczego i Komisji Planowania. Z powodu poważnej choroby najstarszego syna rodzina została zmuszona do przeprowadzki do Charkowa. W listopadzie 1925 roku Możarow został głównym metalurgiem zarządu Południowego Towarzystwa Budowy Maszyn. Od końca 1929 roku pracował w Charkowskim Instytucie Metalurgicznym jako kierownik grupy hutniczej, kierownik wydziału energetyki cieplnej procesów metalurgicznych, a następnie zastępca dyrektora ds. prac naukowych.

Najbardziej znanym dziełem zrealizowanym pod kierownictwem Władimira Andriejewicza Możarowa w latach 30. XX wieku było opracowanie technologii produkcji żelaza ARMCO i żelaza technicznego Toncan. Podczas ewakuacji w latach 1941–1943 pod kierownictwem Możarowa prowadzono prace mające na celu intensyfikację topienia i ciśnieniowej obróbki wlewków stalowych, zastąpienie ukraińskich rud żelaza rudami uralskimi i kuźnieckimi oraz wykorzystanie technologii produkcji żelazostopów z rud lokalnych. Po powrocie do Charkowa naukowiec kierował odbudową zniszczonego przez wojnę ukraińskiego Instytutu Metalurgii i przedsiębiorstw metalurgicznych. Władimir Andriejewicz Możarow zmarł pod koniec 1952 roku.

Artykuł analizuje interesujące, zapomniane i mało znane fakty z biografii wybitnego metalurga, naukowca i nauczyciela Władimira Andriejewicza Możarowa, które stanowią integralną i ważną część historii metalurgii XX wieku.

Słowa kluczowe*: Ural, Irkuck, Charków, UkrNIIMet, Możarow, generatory gazowe, stal, żeliwo, piec martenowski, metalurgia, żelazo ARMCO, żelazo Toncan*

1. Introduction

The history of metallurgy, unfortunately, has many unexplored pages. The work of the outstanding metallurgist Vladimir Mozharov, who worked for many years as the Chief Engineer of the Ukrainian Institute of Metals, is not well known. There are many reasons for this: the Iron Curtain, the classification of research results in metallurgy, which was of great defensive importance in the 20th century, the possibility of obtaining patents, promising license sales to other countries, and publications in highly specialized scientific journals, which are a rare find today. Mozharov's name is practically never mentioned in the literature on the history of metallurgy. One of the few works, in which the name of Vladimir Mozharov is mentioned, is monograph "Outstanding metallurgists and founders of the Kharkov region. Brief essays",[1] which mentions him in the context of his tenure at the Kharkov Institute of Technology, and his work at the Institute of Metals.

The sources of this research were the materials of the Central State Archive of the Highest Organs of Government and Administration of Ukraine, the State Archive of the Kharkov Region, the archive of the National Technical University "Kharkov Polytechnic Institute", the archive of the Ukrainian Institute of Metals, and the Central Scientific-Technical Archive of Ukraine.

The purpose of this article was to conduct the study of information about the creative path of the outstanding engineer and teacher Vladimir Andreevich Mozharov, and about his contribution to innovative scientific research and experimental works that made up the core of world metallurgy science of the 20th century.

[1] A.G. Zhurylo, D.Yu. Zhurylo 2013, pp. 159–160.

The special historical methods were used to achieve this purpose: biographical, historical-genetic, historical-typological and brief biographical data.

2. Becoming the engineer and researcher

The future scientist was born in July 1877 in a family of a rural priest and teacher in the village of Demkino, Ryazan province. The village parish was poor and Vladimir Andreevich's father, Andrei Ivanovich Mozharov, not only served as a priest and a teacher, but was also forced to engage in agriculture to feed his 13 children. Vladimir Andreevich was a gifted child, for example, he taught himself to read at the age of 4.5 by watching his older brothers's study, and at the age of six he was sent to study in a rural school. The school was followed by a *theological school*, which was more accessible for a priest's son. And the next step was the St. Petersburg Theological Academy from which the young man graduated in 1901.[2]

However, a negative attitude towards religion and an affinity for mathematical sciences led Vladimir Mozharov to the St. Petersburg Mining Institute, which he entered in 1901, and completed the full course of study in 1907. At that time, there was no formal division into mining and metallurgical specialties, and mining engineer Mozharov received his education specialization in metallurgy, and not in mining. This was facilitated by his work as a draftsman in the iron-rolling shop of the Putilov plant, where he was mainly involved in the rolling of crucible steel. The young man with an inquisitive mind was interested in learning the secrets of melting high-quality steel. It was not surprising that in his free time he could be found in the plant's open-hearth furnace workshop, where he gradually learned steelmaking, *understood* the structure and learned to work with gas generators. In 1903, he had to leave his job at the factory, since it was difficult to combine it with studies, and Mozharov earned his living by giving lessons. This was not new for him, as he received no financial support from his father from the age of 15.[3]

1905 was a year of revolution and upheaval in the Russian Empire. Due to student unrest, most universities across the country were closed. The St. Petersburg Mining Institute was no exception. There were no classes

[2] Archive of NTU "KhPi", case 10070, p. 13.
[3] *Ibid.*, p. 14.

there for a whole year. But Vladimir Mozharov did not waste time. He meticulously studied all the available literature on gas generators and already in 1906, his first article *Essay on the Latest Generator Systems for Hard Coal* was published in two issues of the Mining Journal (Nos. 9 and 10). In the process of working on foreign sources, Vladimir Andreevich learned to read in three foreign languages at once: German, English and French. Interestingly, Mozharov used not only foreign publications, but also the works of outstanding domestic chemists Dmitri Mendeleev and Karl Blacher. Mozharov's work was edited by Professor Nikolai Aseev,[4] a major specialist in gas generators of that time. The article turned out to be long (36 pages in the first part and 38 pages in the second),[5] and, most importantly, it was perfectly illustrated with diagrams of gas generators, brilliantly drawn by the author. Not surprisingly, the article was soon published as a separate brochure which subsequently was widely used in the selection and design of generator systems for hard coal.

Fig. 1. Vladimir Mozharov
during his time at the St. Petersburg Theological Academy,
1900 (photo from open sources)

In 1906, the St. Petersburg Mining Institute reopened the classrooms and in 1907, Vladimir Andreevich Mozharov received his diploma in mining engineering.[6] He was invited to stay at the institute to prepare for a professorship, but was forced to reject the offer – the monthly salary was only 47 rubles and 50 kopecks, life in the capital of the Empire was

[4] Mozharov 1906a, p. 290.
[5] Mozharov 1906b, p. 38.
[6] Archive of NTU "KhPi", case 10070, p. 19.

expensive, and Vladimir Andreevich was already not only married, but also had two children. His eldest son, Ilya, was born in April 1905,[7] and his daughter Tatyana – in May 1906.[8]

Mozharov went to work in the Urals, in the Ufa province, where he took engineering positions at the Katav-Ivanovsky, Ashinsky, and Ravdinsky factories. There, far from the capital and the benefits of civilization, salary was good and there were opportunities for faster career growth. In practice, Vladimir Andreevich Mozharov managed to broaden his knowledge significantly and further study charcoal, blast furnace, steelmaking and rail rolling production. He had to design and build the open-hearth furnace workshop of the Ashinsky plant, the blast furnace workshop of the Katav-Ivanovsky plant and the bar rolling workshop of the Ravdinsky plant.[9]

Vladimir Andreevich's affinity for scientific work, his ability to apply his knowledge in creative ways and the results of his own research led to the fact that the operation of the open-hearth furnaces of the Ashinsky plant was considered one of the best in the country, and the wood-burning gas generator designed by Mozharov as described in his article "Practical notes on wood generators"[10] began to be considered a classic.

In this article, Vladimir Andreevich substantiates the use of firewood to produce gas, despite the high content of water and tar in it. "There were days when up to 600 buckets of tar were bailed out of all the tar channels with the amount of burned firewood being 22–25 cubic fathoms".[11]

Mozharov's clever proposals made it possible to clean soot and tar off gas pipelines without stopping the furnaces. As a result, under the leadership of Vladimir Mozharov, more than three million pounds of open-hearth steel were smelted over 15 months of continuous operation of the gas generators.[12]

This was a brilliant development of the ideas of Vladimir Mozharov's teacher Nikolai Aseyev and Charles William Siemens on the use of local fuel for smelting steel in a regenerative furnace. However, under the leadership of Vladimir Mozharov, high-quality steel was being smelted from

[7] CSHA of SPb, f. 19, desc. 127, case 1686, p. 148.
[8] CSHA of SPb, f. 19, desc. 129, case 233, p. 131.
[9] Archive of NTU "KhPi", case 10070, p. 17.
[10] Mozharov 1915, pp. 248–253.
[11] *Ibid.*, p. 252.
[12] *Ibid.*, p. 253.

ore[13] using Charles William Siemens' technology, rather than using the scrap-ore process using open-hearth technology: there was no the required quantity of amortization scrap metal in the region. And transporting scrap metal to the Ural from far away was too expensive. Thus, Mozharov's practical activities at the beginning of the twentieth century were at the level of world achievements.

Vladimir Andreevich was one of the first metallurgy researchers of the early twentieth century to evaluate the gas flow friction against of brick channel walls in metallurgical furnaces and to determine the effect of the friction on the stability of the smelting process. He compiled a report on this area of metallurgy based on his experimental studies carried out in factory conditions on air heating devices of blast furnaces. The report, read in 1912 at the 2nd Congress of Metallurgy, was met with the approval of colleagues, and research results were published in a separate publication. The year 1912 also saw translations of this scientific work into English and French.

Mozharov's practical work began in 1907 at the Katav-Ivanovsky plant. In less than two years, he worked in the following positions: head of laboratory, shift engineer, master of the open-hearth furnace workshop, and deputy workshop head. Already in the second half of 1909, the young mining engineer was transferred to the position of manager of the Ashinsky plant. The plant manager's responsibilities included the design and construction of an open-hearth furnace workshop to process locally produced cast iron. The process of building the workshop began at the end of 1909 and was finally completed at the end of 1910. It is interesting that open-hearth furnaces were built not only under the direction of Vladimir Mozharov, but also according to his design. Somewhat later, outstanding metallurgists Mikhail Pavlov and Vladimir Grum-Grzhimailo considered Mozharov's design to be a model furnace.[14]

In 1913–1914 Mozharov worked at the Katav-Ivanovsky plant as chief engineer and was engaged in a reconstruction of the plant (blast furnace workshop, central power plant, cement plant).[15]

In 1914–1916 Mozharov was transferred as a manager to the Revdinsky mining district, where he supervised two metallurgical plants and three mines. He managed to establish blast furnace, open-hearth furnace and

[13] Wood 2004, p. 242.
[14] CSASA, f. 34, desc. 14, case 4769, p. 13.
[15] Archive of NTU "KhPi", case 10070, p. 18.

rolling production in the district. An important achievement of metallurgy at that time was the smelting of nickel cast iron in the blast furnace workshop of the Revdinsky plant from local ores. This was the first experience of smelting domestic nickel-containing ores in a blast furnace with a nickel content in cast iron of up to 3%.[16] The melts were described in a scientific article on the advice of the outstanding metallurgist Mikhail Pavlov much later, after the revolution, in 1936, in the journal "Soviet Metallurgy".[17]

At the end of 1916, Mozharov was transferred to Irkutsk in Siberia. There he managed the Nikolaev metallurgical plants, supervising two metallurgical plants and three mines, and the reconstruction of the plants was carried out under his leadership. Thanks to the active work of Mozharov, the plants continued operations and did not go idle.

From March 1920 to the beginning of 1922, Mozharov worked at the Irkutsk Council of National Economy as head of the Mining Department. He was in charge of coal and salt mines, gold mines, and salt factories. His youngest son, Vsevolod, was born in 1920 in Irkutsk.

In the years 1922–1925 Mozharov worked at the Irkutsk Provincial Executive Committee and at the Planning Commission as deputy chairman. At this time, a serious illness (tuberculosis) of his eldest son Ilya forced the Mozharov family to move to a much milder climate with an abundance of fruits and vegetables. Vladimir Andreevich made his choice in favor of Kharkov, which was at the time the capital of the Ukrainian Republic.[18]

3. The work of Vladimir Mozharov in Ukraine in 1925–1941

In November 1925, Vladimir Andreevich Mozharov and his family moved to Kharkov, where he immediately plunged into the whirlwind of the capital of that time with its noise, crowds, street children, clanging trams, and problems with housing and work. Mozharov took the post of Chief Metallurgist of the Board of the Southern Engineering Trust, and his wife, Elizaveta Ivanovna, had to run the household despite her higher education level. After suffering from tuberculosis, their eldest son, Ilya, was disabled for a long time, and the couple had three children who required care

[16] *Ibid.*, p. 19.
[17] Mozharov 1933, p. 554.
[18] Archive of NTU "KhPi", case 10070, p. 20.

and supervision. Vladimir Andreevich also found time for teaching. Since 1928, he generously shared his knowledge of metallurgy and factory furnaces with students at a number of universities: the Institute of National Economy, the Technological Institute (from 1930 the Mechanical Engineering Institute), and in the 1933/34 academic year, he served as head of the Department of Metallurgy at the Kharkov Medical and Economic Institute.[19]

The position of Chief Metallurgist of the Board of the Southern Machine-Building Trust obligated him to oversee the restoration of several plants: Lugansk Locomotive Plant, Kharkov Locomotive Plant, Nikolaev Shipbuilding Plant, Torez Machine-Building Plant, Taganrog Boiler Plant, Taganrog Tool Plant and others. A highly qualified specialist, Mozharov contributed to the restoration of enterprises and the reconstruction of factory furnaces. For example, at the Torez Machine-Building Plant, an open-hearth furnace was rebuilt without changing the weight of the charge. As a result, furnace productivity increased by 28–30%, and fuel consumption decreased by 18–20%. A unique shaft furnace for the heat treatment of railway tires was designed and built there, and received copyright certificate No. 20409.[20]

Although Mozharov's work at the Southern Machine-Building Trust ended in January 1930 (due to the liquidation of the trust),[21] he continued working on improving metallurgical units at domestic plants until the end of his life.

From the end of 1929, Vladimir Andreevich worked at the Ukrainian Scientific and Research Institute of Metals (then the Kharkov Institute of Metals) as head of the steelmaking group, head of the department of heat power engineering of metallurgical processes, and then deputy director for scientific work. In 1930–1931 during a long business trip of director Nikolai Fedorovich Leve Vladimir Andreevich served as director of the institute.[22]

The formation of the institute was not without difficulties. Founded at the end of November 1928, the institute was chronically understaffed. The research topics were funded, enterprises required solutions to their

[19] *Ibid.*, p. 21.
[20] *Ibid.*
[21] Archive of the Ukrainian Scientific and Research Institute of Metals. Personal file of V.A. Mozharov, p. 15.
[22] *Ibid.*, p. 8.

numerous problems, and there was a shortage of staff, since inviting out-of-town specialists was difficult due to a lack of housing options. For example, by the beginning of 1932, the institute employed only 18 senior researchers, 6 of whom were professors (including the director and his deputy) and 2 were part-time employees. In 1929/30, the institute had 65 employees, 96 in 1930/31, 156 in 1931/32 and 151 in 1932/33.[23] The institute did not have its own premises and was initially located in the former buildings of the Congress of Miners of the South of Russia (Sumskaya Street, 18 and 20), and of the Supreme Council of the National Economy, Yugostal, Yugotop and many other state trusts of that time.

Vladimir Andreevich took an active part in many conferences, congresses, and meetings. For example, in the work of the 1st Congress of the Scientific Association of Metallurgists, the 6th Mendeleev Congress, the 1st All-Union Congress on Quality Steels, the 2nd Conference on the Kerch Problem and others.[24]

In October 1930, the first reorganization of the Kharkov Institute of Metals took place. When it was opened at the end of 1928 it was the second of the branches of the All-Union Institute of Metals, the first branch being located in Leningrad. Already in 1929, two more branches of the All-Union Institute of Metals were opened – in Dnepropetrovsk and Kyiv.

The Kharkov Institute of Metals was transferred from the subordination of the Supreme Council of the National Economy to the Steel Association. From the Institute of Metals, the departments of cold metal working, electric welding and a rebuilt workshop for the production of self-sharpening Ignatiev cutters at the Tool Plant were transferred to the Ukrainian Scientific and Research Institute of Mechanical Engineering, organized in 1930.[25] Naum Prokofievich Gurenko (department head), Arkady Vladimirovich Volfovich, Alexey Vasilievich Tikhonov, Ivan Denisovich Ustimenko, and Vasily Porfirievich Balabolko were transferred to the cold processing department of the Ukrainian Scientific and Research Institute of Mechanical Engineering from the Institute of Metals in May 1931, and Pavel Moiseevich Ivashchenko was transferred to the welding department.[26]

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[23] CSASA, f. 34, desc. 14, case 4043, p. 7.
[24] Archive of NTU "KhPi", case 10070, pp. 21–22.
[25] CSASA, f. 34, desc. 14, case 657, p. 43.
[26] *Ibid.*, p. 59.

In connection with the reorganization, local authorities filed a petition to transfer the Kharkov Institute of Metals to Makeevka,[27] to Kyiv and Dnepropetrovsk,[28] promising to provide the institute with premises, and the staff with housing and work. Locally they believed that moving the institute to their city would contribute to more productive work, and, most likely, they tried to secure a powerful laboratory base for metallurgical enterprises of the region.

However, "Steel" management rejected these requests. More than 2 million rubles had already been spent on buildings to house the Kharkov Institute of Metals and it would have been *impractical* to use them for other purposes. If the Institute of Metals had moved to another city, it would have been difficult, time-consuming, and expensive to provide it with premises, staff, equipment, and apartments. In addition, it was planned to further develop metallurgy in the central part of the USSR (Tula, Lipetsk, Kursk magnetic anomaly). (Time proved the correctness of this planning and staff of the Institute of Metals later actively collaborated with metallurgical plants in the central part of the USSR).

It was taken into account that each of the Institute of Metals (in Leningrad, Kharkov, Dnepropetrovsk and Kyiv) had its own special tasks. For example, the Leningrad Institute was a leader in the production of special steels and alloys, the Kharkov Institute was a leader in the production and pressure treatment of structural, automotive and construction steels, the Dnepropetrovsk Institute – in blast furnace production, the preparation of ores and the manufacture of pipes.[29]

It was decided that the Kharkov Institute of Metals and its experimental workshops would be located in buildings built for it on Sadovo-Kulikovskaya Street (now Darwin Street).[30]

The Steel Association entered into contracts with the Institute of Metals to carry out research and design work before World War II, paid for the results (or most of them) and monitored the implementation of the results. In the first half of the 1930s, most contracts for research work were signed by the chief engineer of the Steel Association, the outstanding metallurgist A.S. Tochinsky.

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[27] *Ibid.*, p. 46.
[28] *Ibid.*, p. 47.
[29] *Ibid.*, p. 63.
[30] *Ibid.*, p. 49.

It should be noted that during the entire period of existence of the Kharkov Institute of Metals, its activities were strictly controlled by the authorities. It was the party and other government structures (state trusts, People's Commissariats, the Ministry of Ferrous Metallurgy, the Council of Ministers of the USSR and the Ukrainian SSR) that determined the topics and content of the bulk of research and design work, and in most cases provided funding. Only starting from the mid-1960s, few opportunities arose to conclude so-called economic agreements directly with enterprises. The research contractor, which was the institute, was obliged to carry out scientific research as stipulated by the technical specifications of a contracting enterprise, aimed at achieving a specific applied or, less often, scientific result.

According to the economic reform implemented in the USSR in 1965, the top management of enterprises began to be accountable for achieving the required indicators. At that time, it became almost impossible to ensure the required increase in the country's national income without introducing scientific achievements into production. Enterprises were allocated a certain portion of their profits for scientific research and the money could not be spent on anything else. If an enterprise did not use its research budget, no funding was granted for scientific research in the following year. As a result, in the years 1965–1980, the annual increase in the national income of the USSR was on average about 5%, and it was even higher in the mining and metallurgical industries. Considerable services to these economic achievements were rendered by the head of the Council of Ministers of the Ukrainian SSR, Viktor Shcherbitsky, whose signature approved most of the decisions of the Ukrainian government on the development of metallurgy and the interaction of scientific organizations with local party structures, trade unions, and local authorities.[31]

Alas, after the collapse of the USSR, the number of economic contracts decreased significantly, economic ties were severed and the centralized planning of research and design work was lost, which had an extremely negative impact on the condition of the Institute of Metals.

Vladimir Andreevich Mozharov managed to organize a scientific school at the Ukrainian Scientific and Research Institute of Metals (UkrNIIMet) to study the behavior of various metallurgical units depending on the refractories, ores, fluxes, fuels and reducing agents used.

[31] SAKhR, f. R-6198, desc. 1, case 405, p. 10; case 314, p. 8.

Prominent representatives of the school were both venerable, experienced engineers, such as Yuliy Yulievich Gapanovich, Pavel Germanovich Rubin, Vasily Efimovich Vasiliev, Ivan Prokofievich Danilov, Evgeniy Evgenievich Farafonov, and younger specialists, for example, Evgeniy Borisovich Kostyuchenko, Ivan Nikitich Frantsevich, Pavel Alexandrovich Alexandrov, Boris Aronovich Bogorov, Alexey Ignatievich Prokhorov, Ivan Benediktovich Ostapchuk, Jonah Davidovich Derechinsky, Moses Aronovich Gershgorn and many others. It should be noted that after a short period of time, young specialists, for the most part, became highly qualified engineers; they carried out serious work in ferrous metallurgy, defended theses, wrote scientific papers and textbooks, a significant part of which became classics.

In 1930–1931, a postgraduate course was organized at the Institute of Metals, which many promising young people attended. The following students studied at the postgraduate school: blast furnace engineers Illarion Borisovich Strelnikov, Ivan Benediktovich Ostapchuk, Boris Andronovich Koval, and Pyotr Nikiforovich Kushnir; steelmakers Moses Aronovich Gershgorn, and Filaret Nikolaevich Agaletsky, metallurgists Karp Nikolaevich Klimov, and Alexander Ivanovich Khinevich, foundry engineer Joseph Semenovich Dugin, heat treaters Mikhail Georgievich Bondarenko, Abram Nikolaevich Ostrovsky, Rudolf Friedrichovich Schmidt, Semyon Grigorievich Serkin, Ivan Nikitich Frantsevich, Ivan Methodievich Rudy and others.[32]

Unfortunately, not all postgraduate students managed to defend their theses, but two of the first class of graduates – Pyotr Nikiforovich Kushnir and Ivan Benediktovich Ostapchuk – soon became directors of the Kharkov Institute of Metals, and Ivan Nikitich Frantsevich subsequently created and headed the Institute for Materials Science Problems, which bears his name today.

The tact and diplomacy of Vladimir Mozharov became useful during the construction of the laboratory and the factory for the Institute of Metals on Darwin Street (then Sadovo-Kulikovskaya Street) and a house for employees on Melnikov Street (now Kulikovskaya Street). The laboratory and factory buildings of the Institute of Metals were built at the end of 1932 and, as finishing work was completed, the institute gradually

[32] SAKhR, f. 806, desc. 1, case 1071, p. 45.

moved to these buildings from 18/20, Liebknecht Street (now Sumskaya Street) in the second half of 1933 and in early 1934.[33]

The institute's laboratory building had a unique layout consisting of two rectangles connected by a cylindrical tower.[34] It is interesting that during the occupation of Kharkov by German troops in 1941–1943, the commissioner of the Institute of Metals wrote in a report to the Nazi command that "the building of the institute has 4 floors and a basement, a usable area of 2,500 square meters and 78 rooms. The building was completely preserved, but 80% of the glazing was damaged".[35]

A residential building for the staff of the Institute of Metals was built in 1932–1933 and without the contribution of Vladimir Andreevich the building process could have taken a long time.[36] Already in 1933, 8 apartments were allocated,[37] and in 1934 the staff of the Institute of Metals not only improved their living conditions, but many obtained their first apartments ever.

Vladimir Andreevich was not an armchair scientist, and in 1931 the first stage of furnace batteries was completed at the Voroshilovgrad plant. The successful operation of the furnaces prompted the plant to implement the second stage of furnace batteries, which were built in 1934. The person in charge of the design and construction work was Vladimir Mozharov.

At the same time, in 1932–1936 he was an active member of the editorial board of the journal "Steel", along with other outstanding metallurgists of that time – Mikhail Aleksandrovich Pavlov, Antony Severinovich Tochinsky, Nikolai Fedorovich Leve, Pavel Germanovich Rubin, Pyotr Grigorievich Ravdel, and Lev Samoilovich Dlugach.[38]

It is interesting that with the beginning of mass repressions, the manner of communication in the journal "Steel" changed dramatically. Until 1937, the periodical's tone was friendly, offering useful research conclusions, with recommendations on increasing the productivity of smelting units and rolling mills, repair and maintenance suggestions, and advice from scientists on increasing productivity and the quality of metallurgy

[33] CSASA, f. 1281, desc. 4, case 2089, p. 11.
[34] SAKhR, f. R-6198, desc. 1, case 91, p. 7.
[35] SAKhR, f. 3076, desc. 1, case 37, p. 2.
[36] CSASA, f. 1281, desc. 4, case 1937, p. 100.
[37] CSASA, f. 1281, desc. 6, case 12, p. 21.
[38] D.Yu. Zhurylo, Mishchenko 2023, p. 1106.

products. Already from the beginning of 1937, the style of the journal became strictly official and dry. Discussions and advice that was tried and tested in practice started to disappear.

Without a doubt, Vladimir Andreevich was the largest domestic steelmaker in the 1930s. Not only did he know perfectly the design and working conditions of open-hearth furnaces, but also had a great intuition about the processes of their work and easily assessed the performance of the smelting equipment. It is no coincidence that he published one of the first domestic works on the durability of refractories in an open-hearth furnace in 1932.[39] Not only the working conditions and durability of refractories were considered in the work, but also the choice of refractories for various smelting conditions, charge types and alloy types.

One of the most interesting projects carried out under the leadership of Vladimir Andreevich Mozharov in the 1930s was the technology of producing ARMCO iron. ARMCO is an abbreviation of name of a steel and iron industry company American Rolling Mill Corporation. At the beginning of the twentieth century, this term denoted low-carbon unalloyed steel with no more than 0.1% of impurities and alloying components. In fact, it was not steel, but technical iron. But such iron has a lot of interesting properties: it has increased weldability, plasticity and electrical conductivity, corrosion resistance and it is indispensable in the production of wire, relay parts for electrical purposes and as a base metal for various precision alloys.

Developed countries of that time sold ARMCO iron for foreign currency and were not willing to share the secrets of smelting this alloy. Therefore, in the early 1930s, the Main Directorate of the Metallurgical Industry and the People's Commissariat of Heavy Industry tasked the Kharkov Institute of Metals with developing of the smelting of ARMCO iron in the conditions of factories in the south of Ukraine. First of all, this material was supposed to be used for manufacturing fireboxes for steam locomotives – the main traction equipment of the railways of that time. The process theory and an original smelting method were developed at the Institute of Metals by Professor Vladimir Andreevich Mozharov and engineers Alexander Ignatievich Prokhorov and Moses Aronovich Gershgorn. They managed to find an original solution to the problem of smelting technical pure iron in an open-hearth furnace. In traditional smelting

[39] Mozharov 1932, pp. 48–57.

technology, the main problem was strong oxidation of the metal, which made it difficult to obtain high-quality metal.

UkrNIIMet staff managed not only to develop a smelting technology, but also to obtain a metal whose impact strength was higher than the norm at the time. Smelting was carried out at the Taganrog Metallurgical Plant (Taganrog then belonged to Ukraine). Enterprise employees who took an active part in the developing the new technological process were technical director M.G. Kolesnikov, chief metallurgist A.P. Skorodumov, workshop chief A.M. Kukushin, smelting master V.I. Kunda, millman B.M. Zaitsev and others.

Without making a secret of his achievements, Professor V.A. Mozharov and engineers A.I. Prokhorov and M.A. Gershgorn published an article stating that from December 16, 1933 to January 4, 1934, the new technology was further implemented at the "Sickle and Hammer" plant in Moscow. Moreover, the first melts in a 15-ton open-hearth furnace were carried out by specialists from the Institute, and then by factory workers. As a result of rolling cast billets, it was proven that the critical temperature range for pure iron is 850–1050°C.[40] Telegraph wire was made from the smelted metal at the K. Liebknecht plant. This was the achievement of the world level in metallurgy at that time: at transition from the reduction of metal with charcoal to the reduction with coke, the smelting of low-carbon non-alloy steel with an impurity and alloying component content of no more than 0.1% was an extremely difficult task.

It turned out that in terms of mechanical properties, wire made from ARMCO iron was not inferior to the wire made from alloy steel.[41]

In appreciation of the results of their work, the Institute team was awarded month's salary bonus. [42]

The production of technically pure iron was further developed in 1938 in the smelting of Toncan iron.[43] This alloy was alloyed with copper and molybdenum, deoxidized with the use of ferroaluminum and was one of the best materials for steam locomotive fireboxes. Interestingly, 'boiling'

[40] Mozharov, Prokhorov, Gershgorn 1934, p. 73.

[41] CSTAU, f. R-13, desc. 1, case 115, p. 39.

[42] Archive of the Ukrainian Scientific and Research Institute of Metals. Personal file of V.A. Mozharov, p. 9.

[43] CSTAU, f. R-13, desc. 1, case 148, p. 5.

Toncan (with a high content of gases) was more prone to natural aging compared to 'calm' Toncan[44] and had higher corrosion resistance.[45]

Thus, the important task of providing the domestic industry with two types of technical iron with unique properties was solved. The problem of finding the material for locomotive fireboxes and workpieces for cold deforming by pressure was no longer interesting for engineers. Consequently, huge foreign currency savings were secured.

In 1934–1935, on behalf of the People's Commissariats of Heavy Industry and Means of Communication, Vladimir Andreevich served as Chairman of the Interdepartmental Commission for the Study of Shaft Workpieces for Rolling Stock Wheels. The project operated on a nationwide scale with implementations at four metallurgical plants and eight machine-building plants.

In September 1936, by order of the People's Commissar of Heavy Industry, Vladimir Andreevich Mozharov was transferred to the Kharkov Tractor Plant, where he worked as Chief Metallurgist and Head of the Central Laboratory. Under his leadership, it was possible to solve the serious problem of introducing tractors with a caterpillar track-type system. Casting tracks from high-manganese steel was a very difficult task at that time. In the USSR, manganese steel began to be smelted only in 1922 at the Moscow plant "Serp i Molot" using its own technology. The company "Vickers Armstrongs Ltd" was the first in the world to develop a technology for casting tracks from high-manganese steel, starting in 1928. In the USSR, with the opening of the Stalingrad and Kharkov tractor plants, there was a need to cast hundreds of thousands of tracks from Hadfield's high-manganese steel.

But under the leadership of Vladimir Andreevich, this problem, like other metallurgical problems, was successfully solved.

Realizing that his scientific work would bring much more benefit than manufacturing activities, in July 1937, Vladimir Andreevich filed an application for seconding him to research work.

In December 1937, Vladimir Andreevich returned to the Ukrainian Scientific and Research Institute of Metals as a researcher. By order No. 879K of March 29, 1939 of the People's Commissariat of Heavy Industry, Vladimir Andreevich Mozharov was reappointed deputy director

[44] *Ibid*., p. 17.
[45] CSTAU, f. R-13, desc. 1, case 191, p. 5.

of the Kharkov Scientific and Research Institute of Metals.[46] The then director of the institute was already Pyotr Nikiforovich Kushnir, who defended his PhD thesis in 1935 and went on to manufacturing. He worked in the blast furnace shop at the New-Tula Metallurgical Plant as shift manager, deputy workshop manager and workshop manager .[47] In 1938, he returned to the Institute of Metals as director, where he worked until August 1943, when he was transferred to Moscow to take the position of editor-in-chief of the Central Institute of Information and Translation of Ferrous Metallurgy.[48]

As deputy director of the Institute of Metals, Vladimir Andreevich supervised many projects: converter production, durability of refractories in melting units, casting of rolling rolls, research into the durability of molds for casting steels and cast irons, refining of metals using the Tochinsky method, rolling and die forming, manufacturing of rails and shafts of railway wheels, heat treatment and steel smelting for the Palace of Soviets, providing technical assistance to factories, unification of prices and production standards, calculation of staffing needs and management of metallurgical enterprises, the use of thermoanthracite and local coal as fuel, problems of Kerch metallurgy, mechanization and certification of workshops and enterprises, dephosphorization and desulphurization of steels and cast irons, chemical and mechanical analysis methods, labor protection and industrial sanitation, etc.

The second most important area of Vladimir Andreevich's work was providing the institute with working equipment. In the early 1930s, the vast majority of the necessary equipment, from Brinell presses to Zeiss microscopes and from turning machines to laboratory electric furnaces was made abroad. Equipment purchases were centralized and arranged by Moscow, with multiple official signatures, justifications and evidence for the need for the equipment.

Unfortunately, most of the equipment purchase documents were destroyed during the evacuation of the institute in 1941. Yet even a short description of the equipment left behind during the German

[46] Archive of the Ukrainian Scientific and Research Institute of Metals. Personal file of V.A. Mozharov, p. 6.

[47] Archive of the Ukrainian Scientific and Research Institute of Metals. Personal file of P.N Kushnir, p. 6.

[48] *Ibid.*, p. 7.

occupation is impressive. Unfortunately, the technical library of more than 20,000 volumes was not moved. Parts of an X-ray device, Tammann and arc furnaces, a pile driver, universal testing machines, presses, metal-cutting and grinding machinery, pyrometers, voltmeters and thermocouples, gas analyzers, scales, a supply of chemical reagents, and laboratory glassware have been preserved. According to the commissioner, laboratory safety ranged from 15 to 60%. Most of the machinery and equipment needed average repairs.[49] It was separately noted that almost all imported equipment had been removed or destroyed.[50]

The active scientific and pedagogical work of Vladimir Andreevich did not go unnoticed and on March 17, 1937, by protocol No. 12/17 of the Higher Attestation Commission of the USSR, he was approved to obtain the academic degree of professor and he was awarded the scientific degree of Candidate of Technical Sciences without defending a thesis. In 1940, by protocol No. 2 of January 11, the Higher Attestation Commission of the USSR granted him the scientific degree of Doctor of Technical Sciences without defending a thesis.[51] One of the reasons for awarding the scientific degree of Doctor of Technical Sciences was Mozharov's fundamental work, "Productivity of an open-hearth furnace and the main determining factors", published in 1938.[52]

It should also be noted that Professor Mozharov edited a number of translations done by his son, Ilya. Despite his poor health, Ilya Vladimirovich brilliantly translated technical literature from English and German, and Vladimir Andreevich edited and supplemented the translations based on his enormous experience and encyclopedic knowledge. Thus, the years 1933–1937 saw the translation and publication of books on the role of refractories in open-hearth furnaces,[53] non-metallic inclusions in iron and steel[54] and the practice of smelting steel.[55]

Before the start of the war of 1941–1945, a lot of interesting work was carried out under the leadership of Vladimir Andreevich Mozharov,

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[49] SAKhR, f. 3076, desc. 1, case 37, p. 3.

[50] *Ibid*., p. 4.

[51] Archive of the Ukrainian Scientific and Research Institute of Metals. Personal file of V.A. Mozharov, p. 17.

[52] CSTAU, f. R-13, desc. 1, case 1061, p. 4; case 162, p. 5.

[53] Larsen *et al*. 1932.

[54] Benedix, Lefquist 1935.

[55] Lister 1937.

such as the project for the removal of arsenic, sulphur and phosphorus from Kerch ores. (It is interesting to note that one of the first to study the negative effect of sulphur on the properties of steels was the outstanding metallurgist, Professor Mikhail Karlovich Ziegler, a graduate of the Kharkov Institute of Technology).[56]

There were also studies of the durability of rolling mill parts: chevron gears (for blooming, rail and beam mills, and medium bar mills)[57] and couplings[58] and work on the calibration of rolling mills, for example to produce Larssen sheet piles.[59] And in the middle of March 1941, research work on the use of a steam engine in rolling Larssen sheet piles was completed.[60]

Special attention was paid to the issues of mechanization in smelting workshops – blast furnaces and open-hearth furnaces of various plants. Mechanization included the unloading of ore and charge, crushing, packaging of scrap metal, scrap removal, cleaning of furnace bottoms, introduction of containers, and more. All this significantly reduced the labor intensity of the process and eliminated heavy manual labor. The Institute of Metals published two volumes on the mechanization of manufacturing.

Under the leadership of Vladimir Andreevich, certification was carried out not only of sections and workshops, but also of entire metallurgical plants. This made it possible to introduce a unification of equipment, narrow the range of technological parameters and ensure the development of best practices at all plants in the industry.

At the same time, the institute's staff carried out pioneering work on the production of cast iron signal bells instead of bronze ones[61] and casting cast iron sheets from ductile cast iron for roofing.[62] There was no comparison in world practice for such work at that time.

[56] D. Zhurylo, Levchenko 2023, p. 420.
[57] CSTAU, f. R-13, desc. 1, case 100, p. 3.
[58] CSTAU, f. R-13, desc. 1, case 138, p. 4.
[59] CSTAU, f. R-13, desc. 1, case 340, p. 3.
[60] CSTAU, f. R-13, desc. 1, case 399, p. 2.
[61] A.G. Zhurylo, D.Yu. Zhurylo 2021a, p. 33.
[62] CSTAU, f. R-13, desc. 1, case 416, p. 22.

4. The activities of Vladimir Mozharov during the evacuation in 1941–1943

The war of 1941–1945 with Germany and the rapid attack of German troops on Kharkov resulted in the need to evacuate the Kharkov Institute of Metals. Unfortunately, a significant part of the Institute's records was destroyed due to secrecy and to prevent technical reports from falling into enemy hands. Back then, metallurgy was the main source of military equipment – from small arms to tanks, ships, aircraft, guns and mortars.

The active offensive of the German army led to the need to evacuate manufacturing enterprises and educational and scientific institutes. As the threat of enemy invasion was looming over Kharkov, two lines of defensive structures were built around the city. Employees of the Institute of Metals also took an active part in the work.

In mid-September 1941, the threat of the Nazis capturing Kharkov became obvious, and the Soviet party and state bodies decided to prepare the city's industrial enterprises and institutions for evacuation. The task was extremely difficult. Sources from the times of 'developed socialism' reported that the evacuation of all of Kharkov's enterprises and institutions took place relatively quickly and in a well-organized manner. Allegedly, the most valuable equipment from the most important laboratories was packed and loaded into railway carriages. To put it mildly, this is not true.

The staff of the Institute of Metals evacuated in groups. According to eyewitnesses, they were given 2 hours to get ready and, having taken the bare essentials, the employees and their families were evacuated to the east. However, many did not go far. The Nazis bombed one of the trains almost within the city limits. Miraculously, the carriage with scientists and researchers suffered less damage than others. Fire, explosions, death of fellow travelers, panic, and screams – how can this be conveyed in words? Some employees, having lost their property in the fire, decided to return home.

Kharkov was occupied by Nazi troops on October 25, 1941. Many volumes have been written by historians to they examine the reasons for such success of the Nazis. They name Stalin's miscalculations, the destruction of the best military leaders, the sloppiness of the economic apparatus, the inability to fight in defense, and many other arguments. But, perhaps, not a single author considered the consequences of the occupation not in terms of material losses, but in terms of social losses, even in case

of loss of not profit, but knowledge; the death of outstanding scientists, infringement of rights and even repression of inhabitants of the occupied territory and discontinuation of their active manufacturing and scientific activities. (In the post-war period, in the resumes that were required in many cases, such as holding a vacant position, traveling abroad, obtaining an apartment, phrase 'stayed in occupied territory' was used).

The failed evacuation of scientific institutes led not only to the loss of tangible assets, but also to scientists being abandoned to their fate. Unfortunately, some of the staff of the Institute of Metals were not evacuated for a variety of reasons.

For the first few days, Kharkov was actually turned over to the Wehrmacht and soldiers tore it to pieces, plundered, destroyed buildings, and shot residents. Already in the first days of the occupation, 116 citizens were hanged from balconies and telegraph poles along the city's main streets.

The first thing the occupants did was to begin recruiting people who were dissatisfied with the communist government to serve in the police and city authorities. The first burgomaster of Kharkov (and the head of the City Government) was former professor of KhTI Alexey Ivanovich Kramarenko, who waited for a change of power for many years. Under his leadership, a population census was carried out. (In less than two years of Nazi rule, as many as three censuses were conducted.) At registration, each adult resident was charged a fee of 1 ruble, while Jews were charged 10 rubles. The Nazis used census records to identify Jews and compile the so-called 'yellow lists' printed on yellow paper. After the censuses, most people of Jewish nationality were exterminated in Drobitsky Yar.

The Nazis demanded to run scientific institutes, primarily the Institute of Metals and the Coal Institute. A Scientific Board was created, headed by Leonid Petrovich Kramarenko, a specialist in agricultural mechanics, and former professor of the Kharkov Institute of Technology. But the work went slowly. Firstly, the specialists who stayed in the city were not particularly willing to transfer their knowledge to the Nazis. They were not opposed, but they were in no hurry to help either. Many of them still remembered completely different Germans from 1918, who were the exact opposite of the fascists. On the other hand, similarly to the City Board, the Scientific Board was constantly changing. Constant reorganizations, structural changes, differentiation of the functions of departments and job responsibilities, creation of new divisions and closing of existing ones, attempts to reduce the head count (and rations), dismissal of secondary

employees – these were the realities of the operation of the Kharkov Scientific Board.

These events did not arise exclusively due to the will and beliefs of L.P. Kramarenko. Strong pressure on both Boards was exerted not only by the Nazi authorities, but also by local nationalists, and life itself. The inability of the Boards to deal with their problems was also of consequence On April 19, 1942, A. I. Kramarenko signed the last order as the chief burgomaster of Kharkov. The German command removed him, giving power to Ukrainian nationalist circles in the person of Alexander Platonovich Semenenko. The ex-burgomaster worked for some time afterwards as chairman of the Scientific and Technical Council. According to the address desk of the City Board, in January 1943 A.I. Kramarenko left his permanent residence for prison. Nothing more is known about his fate.

The Scientific Board made considerable efforts to resume the work of scientific and research institutes in Kharkov. Thus, it was possible to collect the profiles of the researchers and university teachers who remained in the city. They were philologists and doctors, mining engineers and chemists, economists and physicists, librarians and mathematicians, astronomers and metallurgists, representing a variety of specialties.

Several former staff members of the Institute of Metals, including part-time employees, stayed in the city. One of them was Professor Alexander Starobogatov, who became the commissioner for the resumption of the Institute's work. In addition, for various reasons, many metallurgists, millmen, calibrators, and metallurgists stayed in the city, for example, Yuliy Yulievich Gaponovich, Mikhail Nikolaevich Bogachev, Karl Vasilyevich Knoblah, Vadim Borisovich Kovraisky, Mikhail Matveevich Sprangel, Semyon Petrovich Leiba, Olga Borisovna Bakumenko, Anatoly Kuzmich Khodulin, Ivan Andreevich Tsmel, professor Evgeniy Evgenievich Farafonov and others.[63] Some of them could not be evacuated, some were forced to turn back halfway, and some had family requiring care.

Staff were engaged in manufacturing consumer goods in experimental workshops and laboratories, trying to solve food problems, so the institute, despite the reports of Professor Starobogatov, did not actually work. In February 1942, the Nazis appointed a new director of the Institute, S.G. Burakov. Still, practically no scientific work was carried out. The lack

[63] SAKhR, f. 3076, desc. 1, case 37, p. 15.

of heating, electricity, and normal food, the shelling and bombing did little to contribute to the ambitious plans of the German command to restore the Donbas and metallurgical plants of Ukraine.

The staff of the Institute of Metals who managed to evacuate faced enormous difficulties with their everyday life and the main activities of the Institute. For example, the evacuation of Professor Mozharov from Kharkov to the city of Molotov (now Perm) took more than a month.[64]

Despite Mozharov's age (64 years old), he did not have to choose a job. A cold winter was coming and he had to live somewhere, to work, and to receive rations using his ration cards. Vladimir Andreevich's family consisted of 6 people: his wife, daughter Tatyana with two half-orphan children, and his disabled son Ilya. The youngest son, Vsevolod Vladimirovich, volunteered for the front despite an exemption and died at the end of 1941. He was only 21 years old.

Upon his arrival in Perm, Professor Mozharov was sent to work at the evacuated aircraft plant No. 19 as chief of the ferrous metals department. However, there was some confusion. The local police refused to register evacuated specialists as they had been told to send all evacuees to work in the countryside. Employment of metallurgy professors was decided by local authorities. At the same time, Mozharov's children were also given jobs, and they held vacant engineering positions.[65]

Having contacted the director of the Institute of Metals, Petr Nikiforovich Kushnir, Professor Mozharov explained the situation to him. The Institute of Metals was located in the Kemerovo region, in the city of Stalinsk (now Novokuznetsk). Despite all the hardships of wartime, evacuated employees carried out scientific research and applied work.[66]

There was a shortage of qualified specialists, and the management of aircraft plant No. 19 did not let Professor Mozharov go. Resolving Vladimir Andreevich's relocation was difficult and took a long time, even at the level of the People's Commissars (Ministers) of Ferrous Metallurgy and Aviation Industry.[67] It is interesting that by order of the People's Commissariat of Ferrous Metallurgy of December 16, 1941 (No. 19-8-10b), Vladimir

[64] Archive of the Ukrainian Scientific and Research Institute of Metals. Personal file of V.A. Mozharov, p. 8.

[65] *Ibid.*, p. 21.

[66] *Ibid.*, p. 12.

[67] *Ibid.*, p. 13.

Andreevich Mozharov's work at aircraft plant No. 19 was classified as the work of a deputy director of the Ukrainian Institute of Metals.[68]

With the arrival of Professor Mozharov, the research work of the institute's specialists evacuated to Stalinsk, intensified even more.

The war was in full swing and required urgent solutions to wartime problems: boosting the productivity of metallurgical furnaces and rolling mills, improving metal quality, replacing scarce metals and alloys with more affordable ones, clear organization and mechanization of labor, reducing downtime, correct application of material incentives for work performance.

Due to the German occupation of Ukraine, the southern ore deposit was completely lost. It was necessary to find new accessible sources of coke, iron ore, manganese, silicon, and aluminum. Without them, it was impossible to make high-quality steel.

UkrNIIMet staff tried to solve these problems. For example, P.N. Kushnir proposed using magnesium slag in large blast furnaces to smelt ferromanganese.[69] This technique minimized the waste of manganese in slag and, accordingly, increased the yield of ferroalloys from scarce manganese ore. The achievements of Professor E.G. Shumovsky made it possible to replace copper alloy parts in friction units with graphitized steel.[70] Even before the war, UkrNIIMet staff dealt with topics of antifriction alloys. It all started with the production of bearings for small-section rolling mills with inserts made of... wood. It turned out that some types of wood, impregnated with lard, were better as bearing materials than those made of bronze or babbitt.[71] Another solution to the problem led to the use of textolite bearings[72] and obtaining, under the leadership of Professor Evgeniy Grigorievich Shumovsky, anti-friction cast iron, which was called 'KhIM' for the Kharkov Institute of Metals.

Chelyabinsk, in the Urals sawa growing production of tanks and other armored vehicles the two classes being the largest consumers of iron-carbon alloys during the World War II. The Kharkov Engine Plant and the Leningrad Kirov Plant had been evacuated to Chelyabinsk. As a consequence,

[68] *Ibid.*, p. 22.
[69] CSTAU, f. R-13, desc. 1, case 416, p. 3.
[70] CSTAU, f. R-13, desc. 1, case 521, p. 4.
[71] CSTAU, f. R-13, desc. 1, case 11, p. 1.
[72] CSTAU, f. R-13, desc. 1, case 103, p. 20.

more than 18,000 tanks were produced, there, two thirds of which were heavy tanks and one third were medium tanks, and about 50,000 tank diesel engines. Realizing that cast iron and steel were needed to produce armored vehicles, in mid-1943 the USSR government approved a plan to build and increase the capacity of ferrous metallurgy enterprises. A third of USSR's entire metallurgical production during the war years was provided by the Kuznetsk Metallurgical Plant, so research of the Ukrainian Institute of Metals was carried out mainly on this basis. Starting with the development of a new method of steel deoxidation, which provided a significant improvement in metal quality, steel smelting in a 300-ton open-hearth furnace was investigated, which made it possible to find ways to increase furnace melting capacity and produce high-quality steel not only in small open-hearth furnaces, but also in large ones. The work was carried out by Prof. Mozharov and a Candidate of Technical Sciences E.B. Kostyuchenko.[73] V.A. Mozharov was officially thanked for this work with including in his employment history, and he was awarded a cut for a suit.[74]

The use of open-hearth steel met the global trends of the time and made it possible to obtain high-quality metal, from which rails and armor plates were rolled, ships and locomotives were built. Such a furnace did not have special requirements for the quality of raw materials, since it allowed most impurities to be removed from the metal. Despite the fact that high-alloy and special steels cannot be smelted in open-hearth furnaces, it was this design of the furnace that provided metal not only for the needs of industrialization in the USSR, but also for victory in World War II. Most metallurgists of that time were looking for ways to intensify steelmaking, using oxygen, natural gases, new refractory materials, deoxidizers and processing liquid steel with synthetic slags in the furnace. The 300-ton open-hearth furnace was a unique one of that time and remained the main steelmaking unit in the world until the 1960s.

Melted steel was rolled into sheets and profiles according to the studies of P.A. Aleksandrov. His work – "Roll Calibration Analysis for the Rolling Mills of the Guryev Metallurgical Plant and an Assessment of the Possibility of Improvement" – led not only to the design and development of a new original die-rolled profile for a die forming of balancer for tanks, but

[73] CSTAU, f. R-13, desk. 1, case 431, p. 3.

[74] Archive of the Ukrainian Scientific and Research Institute of Metals. Personal file of V.A. Mozharov, p. 50.

also to an increased productivity of die forming hammers and a marked reduction in the number of repairs needed.[75]

Traditionally, the institute's employees were engaged in solving problems of the mechanization of manufacturing. This could compensate for the shortage of workers since a front needed people.

Mozharov's study "Implementation of a Mechanized Closing of the Hatches for Gondola-Type Carriages at the Magnitogorsk Iron and Steel Works Named After Stalin" led not only to a reduction in the number of movers required, but also to a reduced carriage downtime.[76]

The brochures "Verification of Labor Organization, the Use and Retention of Workers, and the Organization of Worker Training and Nutrition at the Kuznetsk Metallurgical Plant..." and "Instructions on the Evaluation of Implementation of Productivity Standards at Ferrous Metallurgy Plants" were devoted to labor organization issues. In these works, measures were identified to promote the combination of functions of professions in ferrous metallurgy.[77]

After the liberation of Kharkov on August 23, 1943, specialists from the Institute of Metals returned to Kharkov in April 1944 and, in parallel with carrying out repairs to the institute's building, joined in the restoration of Donbass factories. These questions were exactly resolved in reports on scientific and research work in the post-war years. Technological support on various issues, such as mechanization of labor-intensive processes in blast furnaces and open-hearth furnaces, the mechanization of loading and unloading processes, introduction of hatch lifts, etc., was provided to many metallurgical and coke plants.[78]

In August 1943, Pyotr Nikiforovich Kushnir was replaced as director of UkrNIIMet by Professor Nikolai Fedorovich Leve, who extremely highly appreciated Vladimir Mozharov for his professional and human qualities.

[75] CSTAU, f. R-13, desc. 1, case 435, p. 4.
[76] CSTAU, f. R-13, desc. 1, case 437, p. 3.
[77] CSTAU, f. R-13, desc. 1, case 438, p. 3.
[78] CSTAU, f. R-13, desc. 1, case 467, p. 3.

5. The work of VladimirMozharov in Ukraine in 1944–1952

Upon returning to Kharkov, Vladimir Mozharov's family was given an apartment at 116, K. Liebknecht Street (now Sumskaya St.). After some bureaucratic delays, the family moved in April 1944.[79]

At the suggestion of the director of UkrNIIMet, prof. N.F. Leve in January 1945, the family of Vladimir Mozharov was put on the list of clients for special service in grocery store No. 1.[80] The living conditions in liberated Kharkov, even in 1946, were difficult. For example, electricity supply was limited. To ensure lighting in Mozharovs' apartment in the morning and evening hours, the directorate of UkrNIIMet sent requests to the director of Kharenergo to enable an unlimited supply of electricity.[81]

In 1944, the Scientific and Technical Council of UkrNIIMet nominated Prof. Mozharov full member of the Academy of Sciences of the Ukrainian SSR.[82] The most flattering words said to Mozharov came from Nikolai Fedorovich Leve. The attendees of the meeting unanimously supported the director of the Institute.

For reasons beyond the control of Vladimir Andreevich, he did not become an academician. The main reason was his non-partisanship, since other criteria – the significance and importance of the work performed under his leadership, the length of his service and the number of scientific articles he published – were satisfied. Perhaps the decision was also influenced by the origin of Vladimir Andreevich. His father and his wife's father were priests, and the attitude towards clergy and members of their families was negative at that time. Science officials were not interested in the fact that most of Professor Mozharov's work was several years ahead of similar world achievements, that only the introduction of the technologies he developed for smelting industrial ARMCO and Toncan irons saved the country a large amount of currency every year, and hat thanks to the work of representatives of his scientific school, tank production in the Urals was provided with first-class metal, smelted not from high-quality Ukrainian ores, but from local ores of unstable quality.

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[79] Archive of the Ukrainian Scientific and Research Institute of Metals. Personal file of V.A. Mozharov, p. 75.

[80] *Ibid.*, p. 75.

[81] *Ibid.*, pp. 92–93.

[82] *Ibid.*, p. 62.

The request from the Personnel Department of the People's Commissariat of Ferrous Metallurgy to the director of UkrNIIMet directly indicated the need to send an autobiography, as well as a political and business profile description of Professor Mozharov. It was separately indicated that they should "inform about his party affiliation".[83]

After the end of World War II, it was necessary to restore the destroyed industry. World history has never seen such destruction and such a pace of restoration. The damage to the Ukrainian industry alone amounted to more than 44 billion rubles. The damage for the People's Commissariat of Ferrous Metallurgy alone exceeded 5 billion rubles. 28 metallurgical plants, 9 pipe plants, 25 coke plants, 27 refractory plants, and 28 ore industry enterprises were completely destroyed. Vladimir Mozharov was among those in charge of restoring the destroyed industry. The volume of work performed can be judged only by two figures. It was planned to spend about 700,000 man-years to restore the ferrous metallurgy enterprises of Ukraine. And about 1 billion pieces of building bricks were required just to restore the destroyed buildings. In less than 10 years, the metallurgical industry of Ukraine was restored.[84]

In May 1945, Vladimir Andreevich was awarded the Order of the Badge of Honor No. 234141, and in June 1946 the Medal "For Valiant Labor in the Great Patriotic War of 1941–1945".[85]

At the end of World War II, Vladimir Andreevich's health began to fail. The death of his youngest son Vsevolod and his brother Mstislav Andreevich at the front, a repressed son-in-law, a 33-day evacuation from Kharkov in a coal carriage, numerous business trips to metallurgical plants, and hard work hard did not improve his health. He suffered a serious illness and surgery and only began to recover from the end of 1943.[86] Doctors tried to restore his health in October and November 1946, at the Sochi resort,[87] and treatment at the resort was repeated in September and October 1948.[88] In June 1949, Vladimir Andreevich was treated at the

[83] *Ibid.*, p. 88.
[84] A.G. Zhurylo, D.Yu. Zhurylo 2013, p. 103.
[85] CSASA, f. 1281, desc. 4, case 2089, p. 15.
[86] *Ibid.*, p. 16.
[87] Archive of the Ukrainian Scientific and Research Institute of Metals. Personal file of V.A. Mozharov, p. 91.
[88] *Ibid.*, p. 101.

Riga Seaside spa.[89] In September 1951, Vladimir Andreevich improved his health at the Professor's Corner spa,[90] and in August 1952 – in the Voronovo holiday home.[91]

Most likely, it was for health reasons that Vladimir Andreevich did not submit an application to the Engineering and Economic Institute in June 1946 for the position of Head of the Metallurgy Chair, although the director of UkrNIIMet provided him with a package of documents for part-time job.[92]

Having a good understanding of the fact that the deputy director of UkrNIIMet is one of the key figures at the Institute, the Institute's director, Nikolai Leve, arranged the nomination of Professor Mozharov to receive the title of Honored Worker of Science and Technology of the Ukrainian SSR in 1947, associating the event with Mozharov's 70th birthday and the 40th anniversary of his scientific and technical activity.

Nikolai Fedorovich Leve was supported by UkrNIIMet staff,[93] the Scientific and Technical Society of Metallurgists,[94] the Party Bureau of UkrNIIMet,[95] the Executive Committee of the Kharkov Regional Council[96] and even local party units.[97] One of the secretaries of the Kharkov Regional Committee of the Communist Party was Boris Koval, one of the first postgraduate students of UkrNIIMet. Due to his metallurgical education, Boris Andronovich Koval perfectly understood the level and importance of applied and scientific research work carried out under the direction of Vladimir Andreevich Mozharov. The support of party leadership turned out to be decisive and in November 1948 Vladimir Andreevich Mozharov received the title of Honored Worker of Science and Technology of the Ukrainian SSR.[98]

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[89] *Ibid.*, p. 136.
[90] *Ibid.*, p. 142.
[91] *Ibid.*, p. 161.
[92] Archive of the Ukrainian Scientific and Research Institute of Metals. Personal file of V.A. Mozharov, p. 98.
[93] CSASA, f. 1281, desc. 4, case 2089, p. 19.
[94] *Ibid.*, p. 12.
[95] *Ibid.*, p. 43.
[96] *Ibid.*, p. 16.
[97] *Ibid.*, p. 6.
[98] *Ibid.*, p. 1.

The enormous influence of party leadership of the time is well illustrated by the following fact. The decision of the Presidium of the Supreme Soviet of the Ukrainian SSR to award the title of Honored Worker of Science and Technology of the Ukrainian SSR to Professor Mozharov was approved in a resolution of the Central Committee of the Bolshevik Communist Party of Ukraine.[99] Thus, at that time the party had complete control over all forms of public life, from scientific activity to the highest authority of the republic.

In June 1948, the Scientific and Technical Council of UkrNIIMet re-nominated Prof. Mozharov full member of the Academy of Sciences of the Ukrainian SSR.[100] As with the first nomination, during the election of full members of the Academy of Sciences of the Ukrainian SSR, the candidacy of Vladimir Andreevich was rejected.

Fig. 2. Honored Worker of Science and Technology of the Ukrainian SSR, Vladimir Andreevich Mozharov (photo from open sources)

However, during the re-evacuation to Kharkov, Vladimir Andreevich was in charge of the restoration of UkrNIIMet buildings, laboratories, and one residential building. In addition, fundamental work on the use of Bessemer steel for rolling rails was carried out under the guidance of Prof. Mozharov,[101] especially the work "Development and experimental

[99] *Ibid.*, p. 2.

[100] Archive of the Ukrainian Scientific and Research Institute of Metals. Personal file of V.A. Mozharov, p. 131.

[101] CSTAU, f. R-13, desc. 1, case 471, pp. 3–4; case 509, pp. 2–4; case 566, pp. 3–4.

testing of technological measures to improve the quality of Bessemer rails",[102] thanks to which significant metal savings were secured as the hollow shaft was 30% lighter than the solid one.

Alas, this work became the basis for Vladimir Andreevich's last article, which was published posthumously.[103]

Vladimir Andreevich passed away on On September 15, 1952, leaving behind a good memory. By order of UkrNIIMet No. 203, he was removed from the list of employees of the institute.[104]

In fact, work carried out under the leadership of Vladimir Mozharov became a solid foundation for the development of continuous steel casting. A great contribution to the development of technology and equipment needed for this most important achievement of metallurgy of the twentieth century was made at UkrNIIMet only 6–7 years after Vladimir Andreevich passed away.[105]

Unfortunately, Vladimir Andreevich's eldest son, Ilya Vladimirovich, only briefly outlived his father and passed away in 1955. His daughter, Tatyana Vladimirovna Mozharova, worked for a long time at the technical library of UkrNIIMet. In 1959, with her active participation, in 1959, the collection of "Scientific Works of the Ukrainian Institute of Metals, Published in 1928–1958" was compiled, which is a valuable bibliographic material. Tatyana Vladimirovna passed away in 1981.

Unfortunately, it is almost impossible to compare the achievements of scientists from different countries in the field of metallurgy and open-hearth production: until recently, most of the achievements in these areas were ones in field of military technology or were a "company trade secret". And the names of scientists and engineers were not advertised. For example, everyone has heard of the Ford T car, which was produced in millions of copies. But finding information about the designer of this car is a difficult task. The same can be said about the work carried out under the supervision of Vladimir Mozharov. Reports of the works on smelting steel for naval ships, on smelting armor steel, on the manufacture of steel cables for the Ministry of Defense are still not available. These works are

[102] CSTAU, f. R-13, desc. 1, case 494, pp. 3–4.

[103] Mozharov, Dubin 1955, pp. 182–204.

[104] Archive of the Ukrainian Scientific and Research Institute of Metals. Personal file of V.A. Mozharov, p. 17.

[105] A.G. Zhurylo, D.Yu. Zhurylo 2013, p. 4.

still waiting for their researchers. But even the works available to historians today allow us to consider Vladimir Andreevich Mozharov one of the outstanding metallurgists of the twentieth century.

6. Conclusions

Vladimir Andreevich Mozharov was an outstanding scientist and teacher of the first half of the twentieth century in the field of ferrous metallurgy. Geographically speaking, the results of his work were implemented in production in the Urals, Eastern Siberia (Irkutsk) and Western Siberia (Novokuznetsk), in the Donbass, and in Ukraine.

Vladimir Mozharov was one of the most qualified specialists in open-hearth furnace smelting. His active work in the field of metallurgy spanned the years from 1907 to 1952.

Vladimir Mozharov is the author of many fundamental published works in the field of metallurgy related to steel smelting, thermal parameters of smelting furnaces, smelting of special steels and technically pure iron in open-hearth furnaces.

Under the leadership of Vladimir Mozharov, more than 3 million pounds of steel were smelted using local fuel. The use of a wood gas generator at the beginning of the twentieth century corresponded to the best world achievements in the field of metallurgy. The originality of Mozharov's technical solution was that the smelting of high-quality steel was carried out from ore, in accordance with the ideas of Charles William Siemens, and not by the scrap-ore process which was traditional for an open-hearth furnace.

Since November 1925, Vladimir Andreevich Mozharov served as the Chief Metallurgist of the Board of the Southern Machine-Building Trust, overseeing the work and restoration of a number of Ukrainian plants: Lugansk Locomotive Plant, Kharkov Locomotive Plant, Nikolaev Shipbuilding Plant, Torez Machine-Building Plant, Taganrog Boiler Plant, Taganrog Tool Plant and others.

In 1928, Vladimir Andreevich began teaching at a number of Kharkov's higher education institutions.

At the end of 1929, Vladimir Andreevich began working at the Kharkov Institute of Metals as head of the steelmaking group, head of the department of heat power engineering of metallurgical processes, and then deputy director for scientific work. In 1930–1931 Vladimir Andreevich worked as director of the Institute.

In September 1936, by order of the People's Commissar of Heavy Industry, Vladimir Andreevich Mozharov was transferred to the Kharkov Tractor Plant, where he worked as Chief Metallurgist and Head of the Central Laboratory. Under his leadership, a domestic technology for casting tracks from high-manganese steel was developed, and existed before one was behind foreign technology by 8–10 years.

In December 1937, Vladimir Mozharov returned to the Ukrainian Scientific and Research Institute of Metals as a researcher and in March 1939, he was again appointed deputy director of UkrNIIMet and held this position until the end of his life.

The most famous projects carried out under the leadership of Vladimir Andreevich Mozharov in the 1930s were the technology for producing ARMCO iron and Toncan technical iron, and numerous works to provide the country with metal used in transport.

Vladimir Mozharov managed to create a scientific school at UkrNIIMet focused on the study of the behavior of various metallurgical units depending on the refractories, ores, fluxes, fuels and reducing agents used, which subsequently ensured the development of the continuous casting of steel – the most important achievement of metallurgy of the twentieth century.

During the evacuation of 1941–1943, work was carried out under the leadership of Vladimir Andreevich Mozharov, to intensify the smelting and pressure processing of steel ingots, to replace Ukrainian iron ores with Ural and Kuznetsk ones, and to produce ferroalloys from local ores. The works on smelting steel in 300-ton open-hearth furnaces were unique ones, and were ahead of technologies of world steel producers by several years. Within a few years, they allowed the USSR to smelt steel in 600-ton open-hearth furnaces.

After returning to Kharkov in 1944, the Mozharov led the restoration of UkrNIIMet and Ukraine's metallurgical enterprises destroyed by the war.

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Bibliography

ARCHIVAL SOURCES

Archive of the National Technical University "Kharkov Polytechnic institute", case 10070: V.A. Mozharov, 25 pp.

Archive of the Ukrainian Scientific and Research Institute of Metals. Personal file of P.N. Kushnir, 9 pp.

Archive of the Ukrainian Scientific and Research Institute of Metals. Personal file of V.A. Mozharov, 162 pp.

Central State Historical Archive of St. Petersburg (CSHA of SPb), f. 19, desk. 127, case 1686: Population records of the church at the Alexander Lyceum. 1905, 381 pp.

CSHA of SPb, f. 19, desk. 129, case 233: Metric book of the Annunciation Church on Vasilyevsky Island. 1906, 396 pp.

Central Scientific-technical Archive of Ukraine (CSTAU), f. R-13, desk. 1, complex 3–5, case 11: Technical report on the theme: Introduction and efficiency of bearings with wooden inserts (combined) in rolling mills. 1931–1933, 26 pp.

CSTAU, f. R-13, desk. 1, complex 3–5, case 100: Technical report on the theme: Stress on the teeth of gear rolls for rolling mills. 1935, 39 pp.

CSTAU, f. R-13, desk. 1, complex 3–5, case 103: Technical report on the theme: Determining the conditions for the possibility of using composite textolite bearings for large-section sheet mills and blooming mills. 1935, 80 pp.

CSTAU, f. R-13, desk. 1, complex 3–5, case 115: Technical report on the theme: Production and research of telegraph wire from ARMCO iron. 1936, 50 pp.

CSTAU, f. R-13, desk. 1, complex 3–5, case 138: Technical report on the theme: Development of design requirements for stress in the connecting parts of rolling mills in order to extend the service life of these parts. 1937, 45 pp.

CSTAU, f. R-13, desk. 1, complex 3–5, case 148: Technical report on the theme: Toncan iron smelting. 1938, 29 pp.

CSTAU, f. R-13, desk. 1, complex 3–5, case 191: Technical report on the theme: Testing Toncan type iron for corrosion resistance. 1938, 5 pp.

CSTAU, f. R-13, desk. 1, complex 3–5, case 340: Technical report on the theme: Developing the calibration and organizing the rolling of Larsen sheet piling at the factories named after Voikov and named after Dzerzhinsky. 1940, 40 pp.

CSTAU, f. R-13, desk. 1, complex 3–5, case 399: Technical report on the theme: On the influence of scratches formed during rolling on the quality and mechanical properties of sheets. 1940, 29 pp.

CSTAU, f. R-13, desk. 1, complex 3–5, case 416: Technical report on the theme: Smelting ferromanganese in a blast furnace of the Kuznetsk Metallurgical Plant named after Stalin on magnesium slag. 1942, 47 pp.

CSTAU, f. R-13, desk. 1, complex 3–5, case 431; Technical report on the theme: The influence of charge weight on the quality of the metal. 1943, 41 pp.

CSTAU, f. R-13, desk. 1, complex 3–5, case 435: Technical report on the theme: Analysis of rolls calibrations for rolling mills of the Guryev Metallurgical Plant and checking the possibility of their improvement. 1943, 79 pp.

CSTAU, f. R-13, desk. 1, complex 3–5, case 437: Technical report on the theme: Implementation of mechanized method of closing the hatches of Gondola-type carriages at the Magnitogorsk Iron and Steel Works named after Stalin. 1943, 13 pp.

CSTAU, f. R-13, desk. 1, complex 3–5, case 438: Technical report on the theme: Checking the state of the labor organization, the use and retention of workers, the organization of training and nutrition of workers at the Kuznetsk Metallurgical Plant, as well as the implementation of the order of the People's Commissariat of Ferrous Metallurgy No. 151 of July 18, 1943, 47 pp.

CSTAU, f. R-13, desk. 1, complex 3–5, case 467: Album of schemes of technical solutions for the mechanization of labor-intensive processes in the main workshops of metallurgical plants in Donbass. 1945, 74 pp.

CSTAU, f. R-13, desk. 1, complex 3–5, case 471: Technical report on the theme: Development and experimental testing of technological measures to improve the quality of Bessemer rails. 1946–1947, 43 pp.

CSTAU, f. R-13, desk. 1, complex 3–5, case 494: Technical report on the theme: Manufacturing a pilot batch of hollow shafts from thick-walled unibody-rolled pipe workpices, study of their properties and testing under service conditions. 1947, 117 pp.

CSTAU, f. R-13, desk. 1, complex 3–5, case 509: Technical report on the theme: Development of a mode for boiling steel smelting in open-hearth furnaces and obtaining a healthy ingot, 1950–1951, 101 pp.

CSTAU, f. R-13, desk. 1, complex 3–5, case 521: Technical report on the theme: Implementation of casting and heat treatment for graphitizing steel. 1948, 49 pp.

CSTAU, f. R-13, desk. 1, complex 3–5, case 566: Technical report on the theme: Improving the production of boiling quality sheet steel. 1948, 37 pp.

CSTAU, f. R-13, desk. 1, complex 3–5, case 1061: Technical report on the theme: The productivity of an open-hearth furnace and its main determining factors. 1938, 18 pp.

CSTAU, f. R-13, desk. 1, complex 3–5, case 1062: Technical report on the theme: The productivity of an open-hearth furnace and its main determining factors. Album. 1938, 11 pp.

Central State Archive of the Supreme Authorities of Ukraine (CSASA), f. 1, desk. 24, case 1012: case No. 2 on the Honored Worker of Science and Technology of the Ukrainian SSR V. A. Mozharov. 1947, 54 pp.

CSASA, f. 34, desk. 14, case 4043: Correspondence with the Ukrainian Scientific and Research Institute of Metals. 1931, 37 pp.

CSASA, f. 34, desk. 14, case 4769: Mozharov Vladimir Andreevich. Deputy Director of the Institute of Metals for Scientific Work, 21 pp.

CSASA, f. 34, desk. 16, case 657: About the transfer of the Institute of Metals to the Steel Trust. 1932, 65 pp.

CSASA, f. 806, desk. 1, case 1071: Ukrainian Scientific and Research Institute of Metals. Staff. 1932, 95 pp.

CSASA, f. 1281, desk. 4, case 1937: Preliminary estimate for work to complete building a residential building at the Scientific and Research Institute of Metals in Kharkov on the Mechnikov street. 1933, 103 pp.

CSASA, f. 1281, desk. 4, case 2089: Correspondence with the Institute of Metals on capital construction. 1933, 26 pp.

CSASA, f. 1281, desk. 6. case 12: Calculations for the Kharkov Institute of Metals. 1935–1936, 281 pp.

State Archives of the Kharkov Region (SAKhR), f. 3076, desk. 1, case 37: Scientific Board of Kharkov. Reports on the condition of equipment, lists of employees of scientific and research institutes. 1941–1942, 292 pp.

SAKhR, f. R-6198, desk. 1, file 91: Plans of placement for the institute's laboratories. 1960, 11 pp.

SAKhR, f. R-6198, desk. 1, case 314: Resolutions of the Central Committee of the Communist Party of Ukraine and the Council of Ministers of the Ukrainian SSR for 1963, 60 pp.

SAKhR, f. R-6198, desk. 1, case 405: Resolutions of the Central Committee of the Communist Party of Ukraine and the Council of Ministers of the Ukrainian SSR related to the activities of the institute in 1966, 77 pp.

STUDIES AND PUBLISHED SOURCES

Benedix, Carl Axel Fredrik; Lefquist, Helge 1935: *Non-metallic Inclusions in Iron and Steel*. Transl. from English by I.V. Mozharov, A.A. Zolotarev. Ed. by prof. V.A. Mozharov. Kharkov; Kyiv: ONTI. State scientific-technical publishing house of Ukraine, 285 pp.

Larsen, Bernard; Schroeder, Friedrich; Bauer, Ernst; Campbell, John 1932: *Service Conditions and Destruction Processes of Refractory Materials in an Open-hearth Furnace*. Transl. from German by I.V. Mozharov. Ed. and with ad. by prof. V.A. Mozharov. Kharkov; Odessa: Steel, 147 pp.

Lister, Walter 1937: *Practice of Steelmaking Production*. Transl. from English by I.V. Mozharov. Ed. by prof. V.A. Mozharov. Kyiv; Kharkov: State scientific-technical publishing house, typography of publishing house in Kyiv, 424 pp.

Mozharov, Vladimir Andreevich 1906a: Essay on the Latest Generator Systems for Hard Coal. *Mining magazine* 9, pp. 290–336.

Mozharov, Vladimir Andreevich 1906b: Essay on the Latest Generator Systems for Hard Coal. *Mining magazine* 10, pp. 1–38.

Mozharov, Vladimir Andreevich 1915: Practical Notes on Wood Generators. *Journal of the Russian Metallurgical Society* 3, pp. 248–253.

Mozharov, Vladimir Andreevich 1932: Conditions for Corrosion of Refractories in an Open-hearth Furnace. *Steel* 5, pp. 48–57.

Mozharov, Vladimir Andreevich 1933: On the Advantages of the Open-hearth Process for the Processing of Kerch Ores. *Soviet metallurgy* 12, pp. 554–556.

Mozharov, Vladimir Andreevich; Dubin, Nikolai Petrovitch 1955: Production of a Pilot Batch of Hollow Carriage Shafts. *Proceedings of Kharkov Scientific and Research Institute of Metals. Metallurgical publishing house*. Kharkov, pp. 182–204.

Mozharov, Vladimir Andreevich; Prokhorov, Alexander Ignatievich; Gershgorn, Moisey Aronovitch 1934: Experience in the Recovery of Pure Iron in the Main Open-hearth Furnace. *Steel* 1, pp. 63–73.

Wood, Henry 2004: Siemens, Sir Charles William (1823–1883), rev. Brian Bowers. *Oxford Dictionary of National Biography*. Oxford University Press.

Zhurylo, Alla Grygorivna; Zhurylo, Dmytro Yuriyovich 2013: *Outstanding Metallurgists and Founders of the Kharkov Region*. Brief essays: monograph. Kharkov: Textbook of National Technical University "Kharkov Polytechnic institute", 260 pp.

Zhurylo, Alla Grygorivna; Zhurylo, Dmytro Yuriyovich 2021a: Cast Iron is a Material for Bells. *Foundry manufacturing* 7, pp. 32–34.

Zhurylo, Alla Grygorivna; Zhurylo, Dmytro Yuriyovich 2021b: Casting Sheets from Iron: A Forgotten Technology. *Foundry manufacturing* 9, pp. 20–22.

Zhurylo, Alla Grygorivna; Zhurylo, Dmytro Yuriyovich; Moiseev, Yuri Vasilyevich 2013: *Theoretical and Practical Principles of Designing Continuous Casting Machines*. Monograph. Kharkov: Textbook of National Technical University "Kharkov Polytechnic institute", 174 pp.

Zhurylo, Dmytro Yuriyovich; Levchenko, Vladimir Nikolayevich 2023: Mikhail Ziegler, the First Professor of Metallurgy at Warsaw Polytechnic, and His Contribution for Developing our Knowledge about Steels. *Studia Historiae Scientiarum* 22, pp. 397–432. DOI: 10.4467/2543702XSHS.23.011.17702.

Zhurylo, Dmytro Yuriyovich; Mishchenko, Marina Mikolajvna 2023: A Brief History of the Journal "Steel" in the Thirties of the 20th Century. *Current issues in modern science* 12(18), pp. 1102–1115. DOI: 10.52058/2786-6165-2023-12(18)-929-943.