Report on the work of the dissertation council for 2025

Dissertation Council at the NAO "Karaganda Industrial University" in the field of personnel training 8 D 072 - Manufacturing and processing industry (educational program 8 D 07202 / 8 D 07203 - "Metallurgy of ferrous and non-ferrous metals" (6 D 070900 - "Metallurgy")

1. Data on the number of meetings held

During the reporting period, 2 meetings of the dissertation council were held:

1) 15.01.2025 – 1 meeting of the dissertation council for the acceptance of dissertations for defense;
2) February 22, 2025 – 1st meeting of the dissertation council for dissertation defense

2. Last name, first name, patronymic (if any) of the members of the dissertation council who **attended less than half of the meetings.**

No

3. List of doctoral students with indication of the OPVO

No.	Full name of the doctoral student	OPVO, where the doctoral student studied	Code and name of the OP	Date and time of defense
1	Mynzhasar Esmurat Amangaliuly	NAO "Karaganda Industrial University"	6D070900 (8D07202) – "Metallurgy" ("Metallurgy of ferrous and non-ferrous metals")	February 22, 2025
2	Esbolat Aybol Batyrkhanuly	NAO "Karaganda Industrial University"	8D07202 — "Metallurgy of ferrous and non-ferrous metals"	February 22, 2025

.

4. Brief analysis of the topics of dissertations considered by the council during the reporting year.

4.1 Analysis of the topics of the works reviewed

During the reporting year, the council reviewed the dissertations of Esbolat Aibol Batyrhanuly on the topic: “Development and study of a new rolling method with the imposition of shear deformations, ensuring an increase in the level of metal processing”, Mynzhasar Esmurat Amangaliuly on the topic: “Development of a resource-saving technology for smelting standard grades of ferrosilicon manganese from low-quality raw materials”

E.A. Mynzhasar's dissertation addresses the pressing issue of processing low-quality manganese raw materials and producing standard grades of ferrosilicon manganese using resource-saving approaches, a topical issue for Kazakhstan's metallurgical industry. The relevance of the study stems from the gradual depletion of high-grade manganese ore reserves, the accumulation of significant volumes of fine-grained waste from the Ushkatyn-III deposit, and the need to reduce domestic enterprises' dependence on imported raw materials. The author proposes a technological solution that allows for the use of fine-grained manganese ore, ferromanganese production slag, and high-ash coal as raw materials, which has both economic and environmental significance.

A strength of the work is its pronounced practical focus. The research is not limited to laboratory experiments but includes a full cycle of work: studying the properties of the raw materials, thermodynamic modeling, laboratory testing, and large-scale laboratory smelting in a 0.2 MVA ore-smelting furnace. As a result, a pilot batch of ferrosilicomanganese weighing approximately 0.5 tons was obtained, the chemical composition of which complies with current standards. This confirms the feasibility of industrial application of the proposed technology.

The scientific novelty of this work lies in the comprehensive metallurgical evaluation of low-grade Ushkatyn-III manganese ores, the determination of their phase composition, and the development of a mathematical model for predicting the manganese and silicon content of the alloy based on thermodynamic modeling. The author also proposed a new charge composition, including ferromanganese slag and high-ash coal, which is supported by a patent for a utility model issued by the Republic of Kazakhstan.

The economic aspect of the study is of particular interest. It has been shown that using inexpensive high-ash coal instead of coke and recycling previously unused waste can reduce the cost of ferrosilicomanganese by \$250–300 per ton while maintaining satisfactory manganese recovery rates. Furthermore, the technology eliminates the need for additional beneficiation and roasting operations, further reducing production costs.

However, some aspects of the work may be the subject of discussion during the defense. For example, the reliability coefficient of the developed mathematical model is $R = 0.85$, which is acceptable for engineering calculations but does not allow for high prediction accuracy. Furthermore, the tests were conducted on a 0.2 MVA unit, which only simulates industrial conditions. Therefore, final confirmation of the technology's effectiveness will require testing it on full-scale production furnaces. The achieved manganese recovery of 76.2% can also be considered a good result for processing low-grade raw materials and waste, but it does not rank among the record-breaking figures in the modern ferroalloy industry.

Overall, the dissertation appears to be a high-quality, applied scientific work focused on solving specific production challenges in Kazakhstan's metallurgical industry. The study's primary strength lies not so much in its fundamental scientific novelty as in the practical feasibility of the proposed solutions, the existence of a patent, process regulations, publications in international scientific journals, and the results of industrial implementation. The work meets the requirements for PhD dissertations in metallurgy and has high practical value for companies in the ferroalloy industry.

A.B. Esbolat's dissertation is devoted to the development of a new rolling method with superimposed shear deformations in relief rolls and aims to address one of the pressing challenges of modern metal forming: increasing the degree of metal refinement and refining the structure without the use of complex and inefficient methods of intense plastic deformation. Unlike many studies in the field of SPD, which focus on small laboratory samples, this work is primarily aimed at creating a technology suitable for the continuous production of long rolled products and thick plate products. This circumstance determines its practical significance and relevance.

The main idea of the study is to use rolling in relief rolls with various types of asymmetry to create additional shear deformations in the metal. This approach allows for a significant increase in cumulative deformation without significantly complicating the process flow. The author performed extensive finite element modeling, examining the kinematic, geometric, and contact asymmetries of the process. It was found that the use of relief rolls avoids the severe strip bending typical of conventional asymmetric rolling, while providing a significantly higher level of metal processing. Particularly interesting is the finding that trapezoidal relief provides an almost fivefold increase in the degree of processing compared to radial roll profiles.

A strength of the work is its comprehensive approach. The research is not limited to computer modeling but includes analytical calculations, the development of a methodology for determining process force parameters, experimental rolling, and subsequent study of the structure and mechanical properties of the materials. The author was able to derive analytical relationships for calculating average rolling pressure and force, and the results are in good agreement with finite element modeling. This enhances the engineering value of the work and makes it useful for designing real-world technological processes.

Particular attention is paid to studying the microstructure of the AD31 aluminum alloy and the M1 copper alloy. It is shown that just three deformation cycles can reduce grain size by more than three times for the aluminum alloy and more than four times for the copper alloy. Simultaneously, an increase in strength properties is observed, confirming the effectiveness of the proposed method as a form of severe plastic deformation. The author also demonstrates that the presence of asymmetry increases the intensity of structure refinement by approximately 30%, demonstrating the significant role of shear deformation in shaping the final properties of the metal.

The scientific novelty of this work appears quite compelling. The author developed a method for calculating the kinematic and energy parameters of a new rolling process, derived analytical relationships for determining rolling forces, and identified patterns in the stress-strain state of metal in relief rolls. Furthermore, the work is accompanied by a utility model patent, further confirming the originality of the technical solution.

However, the study does have some limitations. The primary research was conducted on AD31 aluminum alloy and M1 copper, so the question of whether the results can be generalized to high-strength steels, titanium, or nickel alloys remains open. Furthermore, despite the compelling results of modeling and laboratory experiments, the abstract lacks information on industrial testing of the technology on existing rolling mills. Therefore, the economic efficiency of implementing the new process in a large-scale metallurgical production environment cannot yet be definitively assessed. Furthermore, a significant portion of the scientific results were obtained using numerical modeling, which requires further confirmation in large-scale industrial testing.

Overall, the work appears to be a strong engineering and scientific dissertation in the field of metal forming. While the previous dissertation on ferrosilicon manganese focused primarily on solving the production problem of processing low-quality raw materials, this study has a more fundamental mechanical focus and is related to the development of severe plastic deformation technologies. Its strengths include a high level of mathematical modeling, experimental confirmation of the results, publications in international journals indexed in Scopus and Web of Science, and patent protection for the developed technology.

Overall, the dissertation meets the requirements for a PhD in metallurgy. Its scientific novelty appears somewhat more profound than that of purely applied technological research, and the results obtained may be of interest not only to non-ferrous metallurgy companies but also to the further development of intensive plastic deformation technologies and the production of high-strength sheet materials.

4.2 The connection of the dissertation topics with the areas of scientific development determined by the Higher Technical Commission under the Government of the Republic of Kazakhstan in accordance with subparagraph 2) of paragraph 3 of Article 20 of the Law of the Republic of Kazakhstan "On Science and Technological Policy" and (or) state programs.

Both dissertations directly correspond to the priority area for scientific development in the Republic of Kazakhstan, **"Geology, Extraction and Processing of Mineral and Hydrocarbon Raw Materials, New Materials, Technologies, Safe Products and Designs,"** approved by the Higher Scientific and Technical Commission under the Government of the Republic of Kazakhstan. Each dissertation covers various aspects of this priority and is focused on addressing pressing issues facing the country's industrial sector.

E.A. Mynzhasar's dissertation, "Development of a Resource-Saving Technology for Smelting Standard Ferrosilicon Manganese Grades from Low-Quality Raw Materials," is directly related to the rational use of mineral resources and the development of metallurgical technologies. The work focuses on the processing of low-grade manganese ores from the Ushkatyn-III deposit, as well as metallurgical waste in the form of ferromanganese production slag. The proposed technology reduces the domestic ferroalloy industry's dependence on imported raw materials, increases the utilization of Kazakhstan's own mineral resources, and ensures more complete recycling of metallurgical waste. Furthermore, the use of high-ash coal instead of expensive coke improves resource efficiency and reduces production costs. Thus, the work meets state objectives for the development of deep processing of mineral raw materials, the implementation of resource-saving technologies, and the enhancement of the competitiveness of the country's metallurgical complex.

A.B. Esbolat's dissertation, "Development and Study of a New Rolling Method with Superimposed Shear Deformations Ensuring Increased Metal Finish," follows the same priority, but focuses on developing new technologies for processing materials and producing products with improved performance characteristics. The work aims to improve metal forming processes by implementing an innovative method of asymmetric rolling in relief rolls. The developed technology ensures more intensive refinement of the metal structure, increased strength characteristics, and improved rolled product quality without significantly complicating existing production processes. This research contributes to the development of domestic technologies for the production of high-quality metal semi-finished products and new structural materials with improved properties, which is consistent with the direction of creating new materials and technologies for industry. Moreover, the dissertation itself was completed as part of grant research project AP14869080, dedicated to the development of an innovative method for producing high-quality thick sheet from non-ferrous metals and alloys.

From the perspective of state programs, both theses align with the strategic objectives of Kazakhstan's industrial and innovative development, which are aimed at modernizing the mining and metallurgical complex, increasing the processing efficiency of domestic raw materials, implementing energy- and resource-saving technologies, reducing import dependence, and increasing the output of high-value-added products. E.A. Mynzhasar's work focuses primarily on developing the country's raw material and metallurgical base, while A.B. Esbolat's focuses on improving production technologies and enhancing the quality of metal products. Taken together, both theses contribute to the achievement of the Republic of Kazakhstan's scientific and technological policy goals in the area of sustainable development of the metallurgical industry and increasing its technological independence.

4.3 Analysis of the level of implementation of dissertation results in practical activities

An analysis of the level of implementation of the results of dissertation research shows that both works have a practical focus, but the degree of readiness of the results for industrial use differs significantly.

E.A. Mynzhasar's dissertation is characterized by a high level of practical application. The developed ferrosilicomanganese smelting technology was not only studied at the laboratory level but also tested in a large-scale laboratory ore-smelting furnace with a capacity of 0.2 MVA, which closely approximates industrial conditions. During testing, a pilot batch of ferrosilicomanganese, approximately 0.5 tons in volume, was produced, confirming the feasibility of producing standard alloy grades from low-quality raw materials. Based on the results of the work, process regulations were developed, a test report was issued, a patent for a utility model was obtained in the Republic of Kazakhstan, and the results were implemented at the production site of NPO Marganets LLC. Furthermore, the resulting ferrosilicomanganese was used as a reducing agent in the smelting of other manganese alloys, demonstrating the practical application of the research findings. A key indicator of implementation is the availability of a feasibility study confirming a reduction in production costs of $250–300 per ton. All of this suggests that the project is in the pilot phase and has a high degree of practical feasibility.

Further confirmation of the relevance of the results is the integration of the dissertation materials into the educational process at the K. Zhubanov Aktobe Regional University, where the developed scientific principles are used in teaching specialized courses on ferroalloy production. Thus, the results of the work have found application in both industrial and educational settings.

A.B. Esbolat's dissertation also has a distinctly applied focus, but its implementation should be considered at an earlier stage of technological readiness. The main results of the work are implemented in the form of mathematical models, calculation methods, finite element modeling, and experimental studies on laboratory rolling equipment. The author conducted successful tests on copper and aluminum alloys, confirmed positive changes in the microstructure and mechanical properties of the materials, and received a patent from the Republic of Kazakhstan for the utility model "Rolls for Rolling Thick Sheets."

However, the abstract lacks information on industrial testing of the developed technology on operating rolling mills at metallurgical plants, nor does it include any data on the technology's implementation in a specific company's production process. In fact, the work demonstrates a high level of scientific and technical readiness and confirmation of the technology's effectiveness in laboratory conditions; however, the transition to industrial implementation has not yet been completed. In this regard, the dissertation's results are still in the experimental design and pre-production stages.

Comparing both works, it can be noted that E.A. Mynzhasar's dissertation has reached a higher level of implementation, as its results have been translated into the production of a real metallurgical product, the development of process regulations, and implementation at the company's production site. A.B. Esbolat's dissertation is currently primarily in the process testing and preparation stage for industrial application, although it has significant potential for subsequent implementation in rolling mills. Therefore, the first work can be classified as research with confirmed industrial implementation, while the second represents a promising engineering development, ready for further industrial adaptation and scaling.

5. Analysis of the work of official reviewers (with examples of the most poor-quality reviews)

Official reviewers were appointed in accordance with the requirements of the Model Regulations on the Dissertation Council (hereinafter referred to as the Model Regulations), approved by order of the Minister of Education and Science of the Republic of Kazakhstan dated March 31, 2011, No. 126.

1. **Arinova Saniya Kaskataevna** - PhD, senior lecturer of the Department of Nanotechnology and Metallurgy of the NAO Karaganda Technical University named after Abylkas Saginov, has more than 5 scientific publications in the field of doctoral research (Karaganda, Republic of Kazakhstan);
2. **Kolesnikov Alexander Sergeevich** - Candidate of Technical Sciences, Associate Professor, Professor of the Department of Life Safety and Environmental Protection of the National Joint-Stock Company "South Kazakhstan University named after M. Auezov", has more than 5 scientific

publications in the field of doctoral research (Shymkent, Republic of Kazakhstan);

3. **Bogomolov Aleksey Vitalievich** - Candidate of Technical Sciences, Associate Professor (Associate Professor) of the Department of Metallurgy of the Toraigyrov University, author of more than 10 scientific publications on OP 8D07202 - Metallurgy of Ferrous and Non-Ferrous Metals (Pavlodar, Republic of Kazakhstan);
4. **Panichkin Aleksandr Vladimirovich** - Candidate of Technical Sciences, Head of the National Scientific Laboratory for Collective Use "Technologies for the Hydrocarbon and Mining and Metallurgical Sectors and Related Service Industries" of the K.I. Satpayev Kazakh National Research Technical University, author of more than 25 scientific publications on OP 8D07202 - "Metallurgy of Ferrous and Non-Ferrous Metals" (Almaty, Republic of Kazakhstan);

Based on their review of the doctoral candidate's dissertation and published works, the official reviewers submitted written reviews to the dissertation council in accordance with Appendix 5 of the Model Regulations. In their reviews, the official reviewers stated their decision to petition the Committee for Quality Assurance in Science and Higher Education of the Ministry of Science and Higher Education of the Republic of Kazakhstan (hereinafter referred to as the Committee) to award the doctoral candidate a Doctor of Philosophy (PhD) degree in the academic program. Copies of the official reviewers' reviews were given to the doctoral candidate no later than five (5) working days prior to the dissertation defense. Both official reviewers attended the dissertation council meeting in person for the doctoral candidate's dissertation defense, announced their reviews, and participated in a secret vote.
The official reviewers' work was aimed at a comprehensive and objective assessment of the dissertation research in accordance with established regulatory requirements. Their reviews noted the relevance of the topics, their alignment with current scientific trends, and the practical significance of the results obtained. The reviewers emphasized the scientific novelty of the works, the validity of the methods used, and the correct interpretation of the experimental data. Comments contained in the reviews were constructive and aimed at clarifying specific aspects of the study. The official reviewers demonstrated a high level of professionalism in their work, and the dissertation council has received no comments or complaints regarding the work of the official reviewers.

6. Proposals for further improvement of the system of training scientific personnel

An analysis of the reviewed dissertations allows us to formulate a number of proposals for further improving the system of scientific personnel training in the Republic of Kazakhstan. Both works demonstrate a high level of practical focus and are aimed at solving current problems in the metallurgical industry, while simultaneously identifying a number of systemic features of modern doctoral training.

First and foremost, it seems advisable to strengthen the integration of universities, research institutes, and industrial enterprises at all stages of doctoral training. E.A. Mynzhasar's dissertation demonstrated the positive impact of close collaboration with the Zh. Abishev Chemical and Metallurgical Institute and the production site of NPO Marganets, which allowed for the advancement of research results to the pilot industrial implementation stage. This practice should be more widely adopted and become a mandatory element of training in technical specialties.

An important area for improving the scientific training system is raising the requirements for industrial validation of research results. An analysis of A.B. Esbolat's dissertation demonstrates the high scientific level of the research conducted; however, the lack of information on the implementation of the technology in operating rolling mills limits the practical significance of the results. Therefore, it would be advisable to establish incentive mechanisms for enterprises to participate in the validation of dissertation research and expand programs for joint funding of research by businesses.

The need to develop doctoral students' competencies in digital modeling and mathematical analysis of technological processes deserves special attention. Both dissertations made extensive use of modern methods of computer modeling, thermodynamic calculations, and numerical analysis. This confirms that the training of modern researchers in metallurgy must include in-depth mastery of digital technologies, engineering analysis software packages, data processing methods, and elements of artificial intelligence.

International scientific cooperation should also be expanded. In E.A. Mynzhasar's dissertation, some of the research was conducted at universities in Turkey and the United Kingdom, which contributed to the improved quality of the scientific results. Such collaborations provide access to modern equipment, international scientific schools, and advanced research methods. In this regard, further development of academic mobility programs and joint dissertation supervision with foreign universities seems advisable.

Another area for improving scientific training should be strengthening the focus of dissertation research on the technological modernization of domestic industry. Both studies reviewed are related to mineral processing, resource conservation, and the development of new metallurgical production technologies, which fully aligns with state priorities for scientific and technological development. Supporting such research will ensure a closer connection between science and the needs of the real economy and improve the efficiency of budgetary funds allocated for training highly qualified personnel.

It would also be advisable to develop a system for evaluating the effectiveness of dissertation research not only by the number of publications but also by the level of implementation of results, the presence of patents, the economic impact, and the actual use of developments in enterprises. This approach would encourage research aimed at achieving specific scientific and technical results and improving the competitiveness of the national economy.

Overall, the analysis of the dissertations reviewed demonstrates that further improvement of Kazakhstan's scientific training system should be aimed at strengthening the link between science and industry, expanding international cooperation, developing researchers' digital competencies, and raising standards for the practical implementation of scientific research results. This will ensure the training of specialists capable of not only generating new knowledge but also effectively implementing it in industrial practice.

7. The number of dissertations for the degrees of Doctor of Philosophy (PhD), Doctor of Science in the field of study by areas of personnel training:

1) dissertations accepted for defense (including doctoral students from other OVPO) – 2;
2) dissertations withdrawn from consideration (including doctoral students from other higher education institutions) – 0;
3) dissertations for which negative reviews were received from official reviewers (including doctoral students from other higher education institutions) – 0;
4) dissertations with a negative decision following the defense (including doctoral students from other higher education institutions) – 0;
5) dissertations submitted for revision (including doctoral students from other higher education institutions) – 0;
6) dissertations submitted for re-defense (including doctoral students from other higher education institutions) – 0.

Chairman of the dissertation council Zobnin N.N.
Scientific secretary of the dissertation council Mukhametkhan M.

"30" 12 2025.