Project name, IRN	AP27511881 Research and development of an innovative technology for producing high-quality titanium-containing slag from domestic ilmenite raw materials
Completion date	12.06.2025- 31.12.2027 годы
Project supervisor	Kuatbay Yerbol
Report	The project is aimed at developing a highly efficient and cost-effective technology for producing titanium-rich slag from low-grade raw materials in a smelting furnace. The titanium-rich slag will be used for the production of sponge titanium and for the smelting of various grades of ferrotitanium. The primary goal of the proposed project is to address the issue of the lack of high-quality raw materials for domestic production, which is currently a significant challenge in the titanium industry. Despite the existence of a vast raw material base, Kazakhstan's only producer of titanium-containing products is JSC "Ust-Kamenogorsk Titanium-Magnesium Plant" (JSC "UK TMP"), which produces sponge titanium (an essential material for the aerospace industry) and titanium alloys for foreign consumers. However, the low content of titanium oxide and the presence of impurities in domestic ilmenite concentrates make them unsuitable for producing high-quality titanium-containing products. As a result, JSC "UK TMP" has to purchase these materials, and sometimes even high-titanium slag, from abroad (Ukraine, Canada), which significantly increases the cost of finished products (sponge titanium, titanium white, alloys, and others). This also negatively affects the use of domestic raw materials in general, as it results in a lack of significant demand and the development of technologies for their utilization. The research aims to develop a new technology for extracting high-quality titanium slag containing more than 80% TiO2 from ilmenite concentrates mined from domestic deposits using a carbothermic method in an electric arc smelting furnace. The uniqueness of this technology lies in the fact that the use of ilmenite concentrates for producing titanium slag does not require additional and expensive beneficiation stages. Instead, the technology being developed proposes using fluxing (melting) additives during the slag smelting process, which allows impurities to be transferred into by-product alloyed metal. The implementation of this technology in real-world production conditions will solve a number of problems faced by the mining and metallurgical complex. Primarily, it will enhance import substitution by using local ilmenite concentrates and producing competitive products for the global market, while expanding the range of titanium-containing products and goods produced in Kazakhstan. The titanium-rich slag produced by the developed technology, in addition to its direct use for producing sponge titanium and titanium white, can be used as a source of titanium in the production of high-grade ferrotitanium alloys. Furthermore, the use of domestic raw materials will become more comprehensive and cost-effective by involving ores and concentrates that are not suitable for widespread use in the production processes. By-product alloyed metal produced during titanium slag smelting can

	be used in steel production, further demonstrating the comprehensive nature of the developed technology. Through scientific research, including thermodynamic studies, the selection of an optimal charge composition, testing in large laboratories, and other methods, a technology for smelting titanium-rich slag from low-grade titanium-containing raw materials will be developed. Additionally, a provisional technological regulation for the smelting of titanium-rich slag in an electric arc smelting furnace will be created.
Purpose	The development and optimization of a technology for smelting titanium-rich slag from low-grade mineral raw materials of the Republic of Kazakhstan in an electric arc smelting furnace, simulating industrial conditions.
Expected results	Upon successful completion of the project, the following publications are planned: - At least 2 (two) articles and/or reviews in peer-reviewed scientific journals indexed in the Science Citation Index Expanded of the Web of Science database and/or with a percentile of at least 50 (fifty) in the CiteScore of the Scopus database; - At least 2 (two) articles or reviews in peer-reviewed foreign or domestic journals recommended by lists 1 and 2 of the Committee for Quality Assurance in the Field of Science and Higher Education of the Ministry of Science and Higher Education of the Republic of Kazakhstan (CQAFSHE).
Research group	Project Leader: Kuatbay Yerbol. H-index: (Scopus) - 5; (WoS) - 5; Researcher ID: ABE-5679-2021 https://orcid.org/0000-0002-8400-3537 Scopus Author ID: 57218196966 Co-head of the project: Kelamanov B. H-index (Scopus) - 9; (WoS) - 7; Researcher ID: ABE-5597-2021 https://orcid.org/0000-0001-7646-9153 Scopus Author ID: 25655181100
List of published works	**Kuatbay Y.,** Nurumgaliyev A., Shabanov Y., Zayakin O., Gabdullin S., Zhuniskaliyev T. Melting of high-carbon ferrochrome using coal of the Saryadyr deposit (2022) Metalurgija, 61 (2), pp. 367-370. Квартиль - Q4. Процентиль - 38. **Kelamanov B.,** Yessengaliyev D., Sariev O., Akuov A., Samuratov Y., Zhuniskaliyev T., **Kuatbay Y.,** Mukhambetgaliyev Y., Kolesnikova O., Zhumatova A., Karaidarova Z., Abdirashit A. Technological Analysis of the Production of Nickel-Containing Composite Materials (2024) Journal of Composites Science, 8 (5), art. no. 179. Квартиль - Q2. Процентиль - 76. Yessengaliev D., Mukhametkhan M., Mukhametkhan Y., Zhabalova G., **Kelamanov B.,** Kolesnikova O., Shyngysbayev B., Aikozova L., Kaskataeva K., **Kuatbay Y.** Studies of the Possibility of Improving the Quality of Iron Ores and Processing of Technogenic Composite Iron-Containing Waste of Metallurgical Production (2023) Journal of Composites Science, 7 (12), art. no. 501, DOI: 10.3390/jcs7120501. Квартиль - Q2. Процентиль - 76.