Project name, IRN	**AP19679501** - Development and research of technology for smelting nickel-containing alloys from substandard nickel ores of Kazakhstan
Completion date	01.07.2023-31.12.2025
Project supervisor	Kelamanov Bauyrzhan, Can. Tech. Scien., associated professor
Abstract	Huge reserves of nickel ores in Kazakhstan remain unclaimed due to the lack of capacities and rational technologies for their primary processing in the republic. The total reserves of nickel ores can be estimated at 580 million tons, including 423.5 million tons of proven reserves. Silicate or oxidized nickel ores are not rich ores. They contain a small percentage of valuable components, including nickel (from 0.5 to 1.5%). Most of these ores are waste rock. According to the content of valuable components, they are divided into nickel and iron-nickel ores. The main raw materials for the production of nickel-containing alloys are oxidized nickel ores, the domestic reserves of which are concentrated in the Kempirsai group of silicate deposits located in the Aktobe region. In the west of the country there are such large deposits as: Nikeltau (1.21% Ni), Batamshinskoe (0.87% Ni), Rozhdestvenskoe (1.12% Ni), Kokpektinskoe (1.2% Ni) and others, the reserves of which are about 423.5 million tons. The explored reserves of these deposits are capable of providing processing enterprises with raw materials for hundreds of years. In this regard, there is considerable interest in the study of these deposits and the development of reliable technologies for the production of nickel-containing alloys on their basis, as well as the creation of scientific foundations for the introduction into production of new methods for their production, developing nickel metallurgy in Kazakhstan. The problem of involving oxidized nickel ores in the metallurgical processing in Kazakhstan has not yet been resolved. At present, despite numerous studies on the production of nickel-containing alloys, there are no technologies operating in industrial conditions in the country. Conducted pilot experiments on the production of nickel bloom, nickel matte and blast-furnace cast iron in various metallurgical units (shaft, rotary, plasma furnaces and other units) using nickel ores are still not widely used. In the conditions of foreign plants, nickel-containing alloys are obtained through multi-stage processing schemes by enrichment and agglomeration. Based on this, it is necessary to develop the most effective technology for the smelting of nickel-containing alloys from low-grade Kazakh nickel ores.
Purpose	Development of a resource-saving technology for smelting a nickel-containing alloy by involving substandard nickel ores of Kazakhstan in the metallurgical processing. Study and establishment of general regularities of phase equilibria in systems based on nickel and its compounds.

Expected results	Scope and target consumers of each of the expected results - potential consumers of the results of the ongoing research are the objects of ferrous metallurgy, specifically the production of ferroalloys. The target consumers of the results of the project are scientific and innovative organizations and plants producing nickel alloys and metallurgy industries that have similar problems. Impact of the expected results on the development of the main scientific direction and related fields of science and technology - the scientific results of this project will have a positive impact and progress in the development of science and technology in the field of nickel metallurgy. Applicability and (or) the possibility of commercialization of the obtained scientific results - upon receipt of positive results of the project in terms of technical and economic indicators of the technology, it is necessary to conduct pilot tests with subsequent commercialization. Social, economic, environmental, scientific and technical, multiplicative and (or) other effect of the project results with justification. Expected socio-economic effect: - reduction of social tension in industrial centers due to the creation of new jobs; - reduction of power consumption and improvement of technical and economic indicators of the electric smelting process. The expected environmental effect is the harmless storage and use of slag for the needs of construction by obtaining slag with a stable structure in a lumpy state. Expected scientific and technical effect: - data will be obtained on the thermodynamics and phase structure of the nickel alloy according to the existing and developed technology; - fundamental information will be obtained on the kinetics of the processes occurring during the development of carbon thermal processes of nickel alloys; - development of theoretical foundations for the creation of technology for the production of nickel alloys, in terms of the use of a cheap reducing agent. The multiplier effect is to obtain nickel alloys with a reduced cost, a positive impact on the economy of the plant, and the production of slag that does not crumble. In the implementation of the project, a modern thermochemical software package with universal modules for modeling technological schemes - HSC Chemistry will be used, which will significantly reduce the number of experiments required to develop the production and use of a reducing agent in the production of nickel alloys.
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Publications in scientific publications	Келаманов Б. С., Есенгалиев Д. А., Сариев О. Р., Қуатбай Е. Қ., Жунісқалиев Т. Т. Ni-Fe-C-O төрт компонентті жүйесін термодинамикалық-диаграммалық талдау тұрғысынан зерттеу // Наука и техника казахстана – 2023, 3, с. 163-172 https://doi.org/10.48081/XNZI9820