BR24993020 “Development and implementation of technology for the production of complex-alloyed steels with homogeneous structure due to synergistic effects on the melt”- s.r. Issagulov A.Z.

Relevance: This program proposes a new approach to solving the problem of creating components made from complex-alloyed steels with enhanced operational properties. It focuses on minimizing costs for improving the mechanical properties and service life of components made from such steels.

Objective of the project: Development of technology for manufacturing complex-alloyed steels with homogeneous and defect-free structure due to synergy of external and internal influence on the melt in the process of primary crystallization by nanopowder modifiers, inoculants and combined magnetic and vibration treatment to improve the performance properties of castings and subsequent implementation of the technology in production.

Expected and Achieved Results*:*

- Monitoring the Kazakhstani market and conducting an informational analysis of the production and use of complex-alloyed steels to select the optimal type of external and internal effects;
- Monitoring the global market to identify the range of complex-alloyed steels and the challenges of their production and use;
- Development and implementation of logistical measures for the effective realization of all technological stages. Experimental studies on the selection of nanopowder modifiers and inoculants;
- Creation of a website to provide information about the program.

Currently, the metallurgical industry of Kazakhstan lacks the main facilities for the production of alloyed steels (electric arc/induction furnaces). Therefore, at this stage, it is most reasonable to improve the properties of the already produced range of alloyed steels, including various types of treatments. Today, the global market for leading steel producers is dominated by the production of alloyed and high-alloyed steels, while in Kazakhstan, carbon steels primarily dominate the market. This is due to the fact that the main steel producer in Kazakhstan, Qarmet, only has converter furnaces designed for the production of carbon and low-alloyed steels. The share of other producers in the total steel output is small.

The preliminary selection of nanopowder modifiers and inoculants has been justified. The complex modifier INSTEEL has been selected as the modifier-inoculant. This modifier contains alkali metals, rare-earth metals (REMs), and a strong carbide-forming agent. The key feature of using this modifier, compared to existing methods, is the use of the modifier in the form of nanopowder and the method of its introduction.

It has been established that the introduction of the complex modifier as a nanopowder results in visible changes in the dispersion of the structure and an increase in properties such as strength, hardness, and wear resistance.

A website for the program has been created, where information about the program, its implementation results, achievements, and participant details are provided: (https://inocumet.kz/).

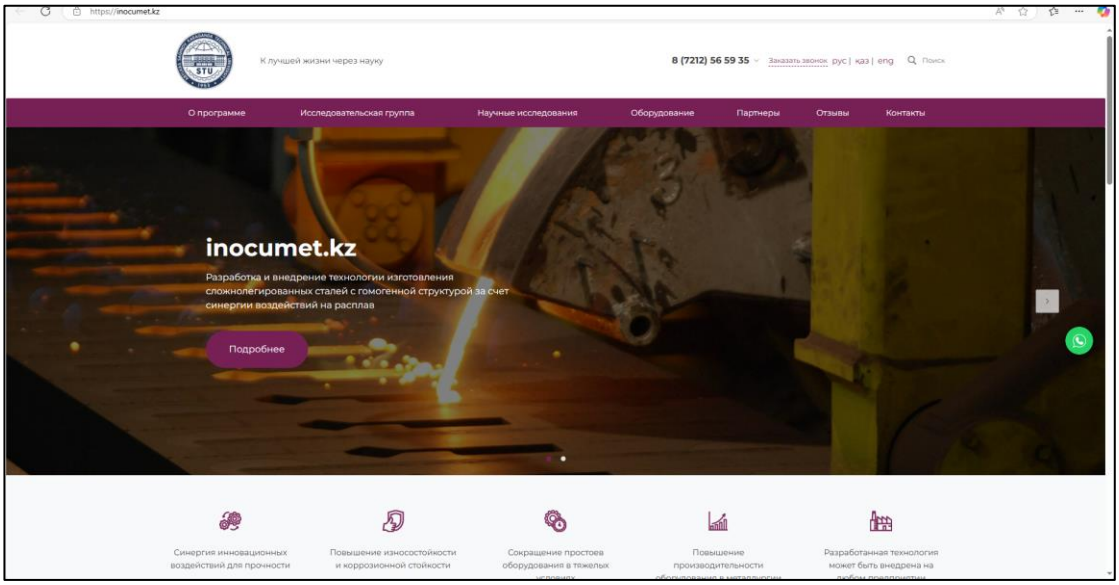

Figure 1 – Program Website, providing information about the Program, its implementation results, and achievements

Research Group

The group consists of 35 members, including 16 individuals under the age of 40, and 18 individuals holding academic degrees.

The consultants are:

- PhD, Prof. O. Chernyshyus (Vilnius Gediminas Technical University, Lithuania);
- Candidate of Technical Sciences, Associate Professor P.V. Kovalev (Peter the Great St. Petersburg Polytechnic University, Russia)

Information for Potential Users:

The new knowledge gained will contribute to the development of the national school of materials science and metallurgical physics, which will elevate domestic metallurgical science to a fundamentally new level.

Scope of application:

The scope of this program includes metallurgical and mechanical engineering production for enterprises such as JSC “Qarmet,” LLP “Parkhomenko KMZ” and other.

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