

ABSTRACT

of thesis on scientific degree competition « Philosophy Doctor» (Ph.D) of Toleuova Ainagul Rymkulovna on a specialty 6D071000 - Materials science and technology of new materials

Theoretical and experimental studies of phase and structural transformations in aluminum alloys on the basis of a new generation of aluminum alloys Al–Cu–Mn–Zr

The main task of theoretical and experimental studies on the thesis is to optimize the composition and structure of aluminum alloys of base system Al–Cu–Mn–Zr.

Relevance of research. The program of accelerated industrial–innovative development of Kazakhstan provides the creation of industrial enterprises oriented to the production of final products with high added cost of the domestic, including aluminum materials. Due to the rapid development of all sectors of industrial production, particularly, engineering, instrumentation, oil and gas industry, metallurgy and chemical industry, aviation and space technology, the demand for aluminum alloys in the near future will increase sharply.

It is proposed fundamentally new group of aluminum alloys for the production of deformed semi finished products (including: sheets, rods, wire, panels, pipe, stamping and forgings). These semi-finished products can be used in a variety of transportation and building products (including: disks of car wheels, chassis and racks covering, doors, partition walls, etc.). The reference system for these alloys is a system of Al–Cu–Mn–Zr for the content of alloying components is not more than 5 weight %, and the usual requirements for impurities (including the iron). By the level of the initial mechanical properties of the proposed and used alloys are approximately in the same level ($\sigma_B=250-350$ MPa). Feature of the proposed alloys is that the technological cycle of obtaining semi–deformable substantially is shorter. In particular, there is no operation of homogenization (bars) and tempering (semi–finished products).

Object and subject of research. Phase diagrams of multicomponent systems based on aluminum; aluminum alloys and heat-resistant aluminum alloys and their processing technologies, methods and programs of the phase transformations' calculation and phase diagrams of metal building systems.

The goal of the work. Calculation and experimental construction of the phase diagrams of multicomponent systems based on aluminum, on their basis the development of new heat resistant aluminum alloy castings and their modes of heat treatment.

Methodological basis of research (the methods and forms of scientific research, comparative analysis of scientific approaches to scientific research).

On the theme of the dissertation following methods were used when doing research:

- optical and electron microscopy;
- scanning electron microscopy to analysis of elemental chemical composition of alloys;
- differential thermal analysis;
- determination of the mechanical properties;
- determination of the corrosion properties of alloys;
- methods of theoretical calculations and computer programming.

The novelty of the thesis' theme. For the first time it is supposed to substantiate the relationship between changes in the structural parameters of the atomic crystal structure of substances and thermal effects in phase transitions. It is developed the new methods and computer programs calculation of phase diagrams in equilibrium and non-equilibrium cooling. It is obtained the new heat-resistant alloys, their technology casting and heat treatment.

Expected scientific and technological level of development. The level of scientific research on the dissertation theme meets the objectives of the development of fundamental science in the field of materials science and technology of new materials.

Dissertational work was performed as part of financed by state budget: 1) STP № 723 **YFM.09** «The development of new competitive processing technology of finished products from metals and alloys (thermal, chemical-thermal, thermomechanical and surface treatment, pressure treatment, etc.), as well as coating technology»; 2) № 747 MES.SF.12.17 « Development of the theoretical foundations of new alloys and advanced functional materials with a given level of properties». Priority: 5. The intellectual potential of the country. 5.1. Fundamental research in the natural sciences.

The main results of the dissertation research have been published in 20 papers that meet all the requirements of the Committee for Control of Education and Science of MES RK.

The volume and structure of the thesis. The dissertation consists of 137 pages of typewritten text, includes an introduction, four chapters and a conclusion, 78 figures, 21 tables and a list of sources used 105 items.