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SUYUQLANTIRISH JARAYONIDA KIRITILGAN MODIFIKATORLAR NATIJASIDA KULRANG CHO‘YAN STRUKTURAVIY O‘ZGARISHLARINING TAHLILI.

ANALYSIS OF STRUCTURAL CHANGES AS A RESULT OF MODIFIERS INTRODUCED IN THE PROCESS OF LIQUEFACTION OF GRAY CAST IRON.

АНАЛИЗ СТРУКТУРНЫХ ИЗМЕНЕНИЙ В РЕЗУЛЬТАТЕ ВВЕДЕНИЯ МОДИФИКАТОРОВ В СЕРЫЙ ЧУГУН ПРИ ОЖИЖЕНИИ.

Annotatsiya: Maqolada kulrang cho‘yan qotishmasiga elektr yoy pechida suyuqlantirish jarayonida modifikatorlar kiritib olingan namunalarning mikrostrukturaviy tahlili keltirilgan. Qum-gilli qolipga quyilgan namunalar skanerlovchi elektron mikroskop yordamida o‘rganildi va olingan mikrostrukturaviy tahlillar yordamida namunalarning mexanik, fizik va texnologik xossalarining o‘zgarishini asoslashda muhim ahamiyat kasb etdi.

Kalit so‘zlar: cho‘yan, kulrang cho‘yan, SCH24, JSM – IT200, Axiovert 40 MAT, suyuqlantirish, quyish, perlit, ferrit, mis fosfi, ferrosilikon, qotishmalar**.**

Abstract: The article presents a microstructural analysis of gray cast iron alloy samples with modifiers introduced during liquefaction in an electric arc furnace. The samples poured into the sand-clay mold were studied using a scanning electron microscope, and with the help of the obtained microstructural analysis, they became important in justifying the changes in the mechanical, physical and technological properties of the samples..

Keywords: cast iron, gray cast iron, SCH24, JSM – IT200, Axiovert 40 MAT, fluidization, casting, pearlite, ferrite, copper phospite, ferrosilicon, alloys.

Аннотация: В статье представлен микроструктурный анализ образцов сплава серого чугуна с модификаторами, введенными при ожижении в электродуговой печи. Образцы, залитые в песчано-глиняную форму, были изучены с помощью сканирующего электронного микроскопа и с помощью полученного микроструктурного анализа стали важными для обоснования изменений механических, физических и технологических свойств образцов.

Ключевые слова: чугун, серый чугун, SCH24, JSM - IT200, Axiovert 40 MAT, псевдоожижение, литье, перлит, феррит, фосфид меди, ферросилиций, сплавы.

Introduction

Gray cast irons are the most widely produced and used black alloys. It has high flowability, workability, strength, hardness and permeability properties. Mechanical properties mainly depend on the microstructure of gray cast iron, which usually consists of fine graphite, pearlite and ferrite structures.

An alloy is a material obtained by mutual liquefaction of metal and metal, as well as nonmetals. A metal alloy is an alloy of metals and metals. The category of metal alloys also includes alloys with a large amount of metals and alloys with the properties of metals and

metalloids. In technology and industry, not pure iron, but its alloys with other metals or metalloids are widely used.

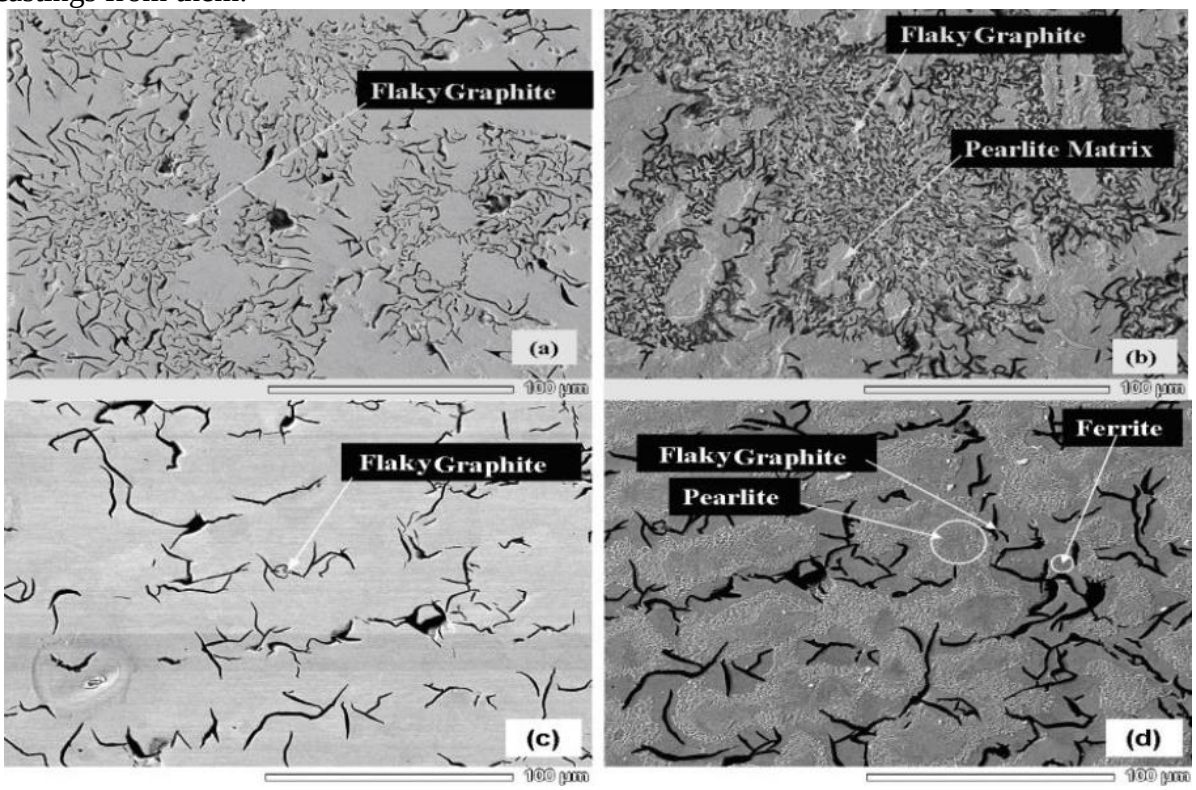
It is known that metals and non-metals consist of continuous movement of molecules and atoms, and their properties are different depending on their location and interconnection in space. When the internal structure of materials is studied by X – rays, the atoms of metals and alloys are arranged in an orderly manner through mutual attraction and form a crystal lattice [1 – 4].

It should be noted that the following main tasks are important in the preparation of thin-walled details from gray cast iron obtained today by the casting method:

– based on the analysis of the chemical composition, structure and properties of the used gray cast iron alloy, development of the chemical composition of thin-walled cast iron without reducing its mechanical properties;

– development of the technology of casting high-quality cast products of gray cast iron alloy without mechanical processing;

– to check the amount of clay needed to improve the quality of sand-clay molds used for casting thin-walled cast products and to develop a technology for obtaining high – quality castings from them.



Pic 1. Microstructure of Gray Cast Irons, (a) un-etched and (b) etched conditions for Fe-C-Si alloy system whereas (c) un-etched and (d) etched conditions for Fe – C – Al alloy system

Picture 1 shows a front view of gray cast iron under an optical microscope. It can be seen that the microstructure of the gray cast iron sample consists of pearlite, ferrite and graphite. 80% of the pearlite and ferrite matrix consists of pearlite, and the proportion of graphite is approximately 15% [5].

Main part

The DSP – 05 electric arc furnace was chosen for casting experimental samples in the "Casting Mechanics" workshop of O'zmetkombinat JSC. Gray cast iron of the SCH24 (GOST 1412 – 85) brand and ferrosilicon FSi75 (GOST 1415 – 93), ferromanganese FMn88,

FMn90 (GOST 4755 – 91), copper phosphide CuP_2 – 9, CuP_2 – 10 (GOST – 4515) were used.

The following solid (SCH24), secondary cast iron alloys were used to liquefy the samples of this experiment. Particular attention was paid to the fact that the content of phosphorus and sulfur, which are harmful elements in the mixture, does not exceed 0.01 – 0.04%. The temperature of liquefaction during casting of the researched samples was from 1400 to 1470 ^{o}C. Before pouring the liquefied alloy into the furnace, slag cleaning was performed. The temperature of pouring the liquefied alloy into a sand-clay mold was 1400 to 1460 ^{o}C.

The liquefied alloy was poured into a sand-clay mold and its cooling rate was 30-35 degrees/min. In order to check the mechanical properties, in the preparation of the mold for the cast samples, the mold mixtures were pressed into a mold made of a special board and these samples were cast. [6 – 8].

Picture 2. Samples cast in an electric arc furnace from a gray cast iron alloy in a sand-clay mold for research.

Surface cleaning of cast samples was carried out for mechanical properties and structural analysis. After the samples were prepared for research, the chemical composition of alloys was determined using the “SPECTROLAB LAV M12” equipment, the microstructure was determined using the “Axiovert JSM – IT200” and “Axiovert 40 MAT” microscopes, and the hardness was determined using the “Hardness tester TB 2109” equipment.

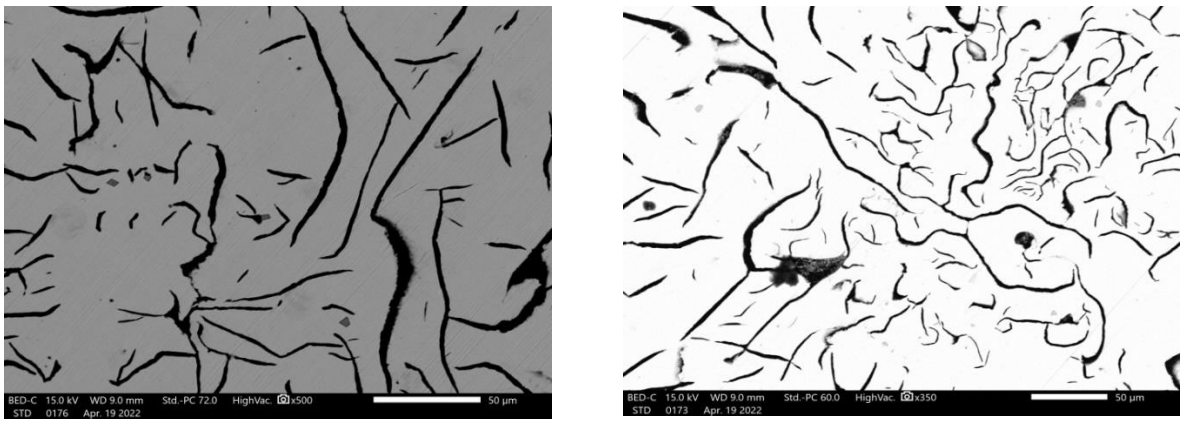
The microstructural analysis of the obtained samples and their volume distribution along the surface were determined using a scanning electron microscope (JSM – IT200 SEM). In a vacuum, a scanning electron microscope exposes the sample to electrons captured by an electric current and determines their quantity by recombining the contained electrons. The lack of electrons was seen as the main reason for inaccuracies in determining the amount of some elements in the sample using a scanning electron microscope. During the chemical analysis of the prepared samples, inaccuracies were observed in determining the amount of silicon in the composition of gray cast iron [9 – 11].

Samples with a diameter of 10 mm and a length of 25 mm are cut from the alloys, and their surface is treated for a certain time with abrasive papers of 500, 800, 1000, 1500, 2000 microns. After that, the surface of the samples is smoothed using WC (tungsten carbide) paste. After the polishing process, the reagents are exposed according to GOST 5639 – 82. As reagents, picric ($C_6H_2(NO_2)3OH$) and hydrochloric (HCl) acids are exposed for approximately 5 minutes. Exposure of the reagents to the surface of the sample is the division of the structures of the analyzed samples into phases, as well as its microscopic examination. As a result, it became possible to obtain results by dividing the structures of gray cast iron into clear boundaries (pic. 3)

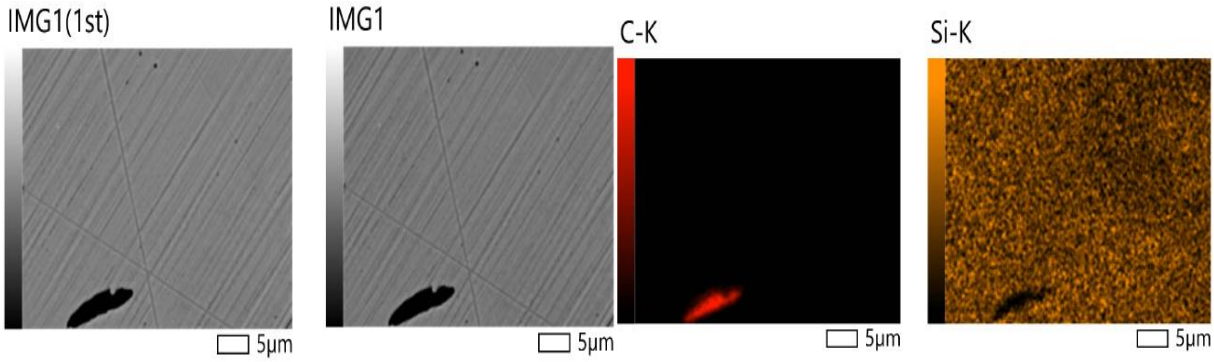
Picture 3. Samples prepared for examination in JSM – IT200 scanning electron microscope.

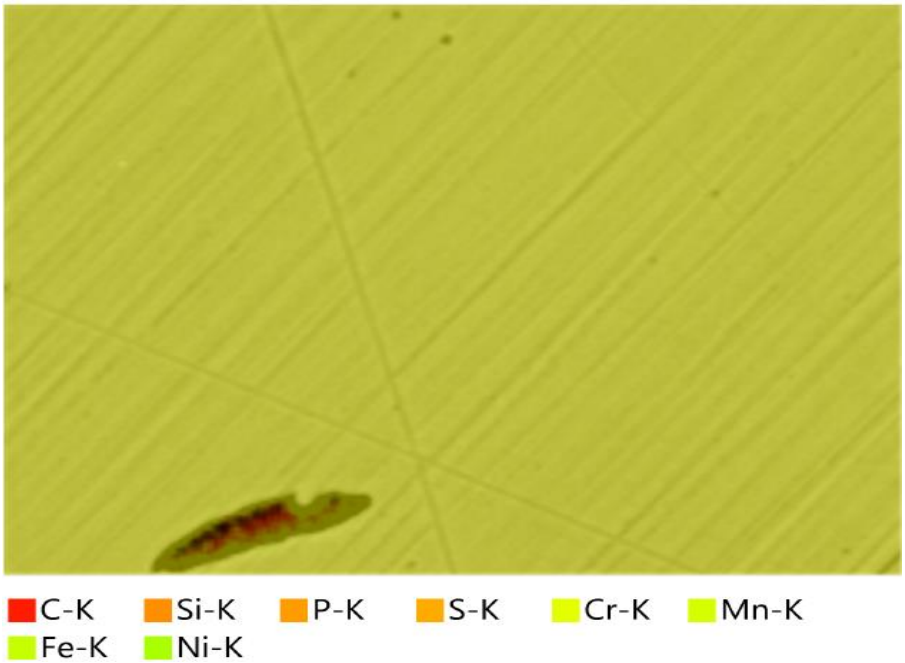
Results

SCH24 gray cast iron samples are magnified by JSM-IT200 scanning electron microscope from x100 to x5000 times at the Uzbekistan-Japan Youth Innovation Center of Tashkent State Technical University named after Islam Karimov, in the central research laboratory of O‘zmetkombinat JSC enterprise Axiovert 40 MAT x100 times The microstructural and elemental content of the magnified up to x1000 was studied (pic. 4).



Picture 4. JSM – IT200 Scanning Electron Microscope image at x350, x500, x1000 magnification.





Picture 5. JSM - IT200 scanning electron microscope image at x5000 magnification.

Figure 5 above shows the JSM-IT200 scanning electron microscope image at x5000 magnification and the elemental content of the bulk samples. In this SEM microscope, the size distribution of each element is shown in different colors. Based on these obtained results, it is possible to justify the change of the properties of the cast samples from the point of view of material science. Also, the modifiers added to gray cast iron serve to add additional elements to it based on the structures created and to obtain high-quality cast products and introduce them into production.

CONCLUSION

Based on the microstructural analysis of thin-walled cast iron samples, by determining its mechanical properties, a cast product of high structural size and quality is cast in a sand-clay mold using modern casting technologies. In this case, gray cast iron alloy is poured into a cast product of exact size and quality using various modifiers in a furnace and a ladle. It is known that the uniform volume distribution of elements over the surface is important in casting from thin-walled gray cast iron**.**

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