ETHIOPIAN INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH

eISSN: 2349-5715 pISSN: 2349-5707

Volume: 11, Issue 04, April-2024 SJIF 2019: 4.702 2020: 4.737 2021: 5.071 2022: 4.919 2023: 6.980 2024: 7,662

GENERAL INFORMATION ON METALLOGRAPHIC ANALYSIS

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Abstract: In this article, the macrostructure of alloys is studied by the methods of metallographic analysis with the help of an ordinary eye and an optical magnifier. Today, the structure of metals and alloys is studied by macro and microanalysis, X-ray, as well as defectoscopy (X-ray, magnetic, ultrasound and other methods). The macrostructure, that is, the visible structure, is studied with the naked eye or with the help of an optical magnifying glass. Such large defects, i.e., cracks, depressions, gas bubbles, etc., as well as the uneven distribution of impurities in the metal, are determined.

Basic word: Macroanalysis, microanalysis, X-ray analysis, large defects, cracks, pits, gas bubbles, fracture, brittle fracture, fibrous fracture, granular fracture, brittle fracture, granular fracture.

Enter: In the increasingly growing machine-building industry of our independent Uzbekistan, in the creation of new materials in all aspects of production, it is very necessary to increase the quality control and analysis of materials. In this article, the development of new modern technological processes and their step-by-step quality control in order to increase the lifetime of the operational properties of materials are widely covered. The information necessary to determine the quality control of metals is provided.

Metallography - finding information about the structure of metals. Currently, due to the increase in the number of composite substances, as well as the development of additional materials (ceramic and metal systems, metal-plastic systems, etc.), priority is given to the description of "Materialography". Fields of metallography, i.e. materialography, are mainly used in engineering work, along with quality control and damage analysis [1].

The main part

Macro analysis of the sample. With the help of macrostructure, the broken place of metals is studied according to the macroslide. A macroslide is a sample of metal and alloy, one side of which is polished, thoroughly degreased, treated with special reagents, and observed under a magnifying glass with a magnification of 5-10 times. The technology for preparing macroslides for macroanalysis from metal and its alloys is as follows: the sample being examined is divided into two parts using a hacksaw or a lathe. If the macroslide is prepared from the surface of the cross section of the detail, then it is called a template. The sample is cleaned on the machine using an ego or an abrasive wheel, then the sample is polished on metallographic grinding papers, in which the metallographic grinding papers are polished, then the metallographic grinding papers are moved from large numbers to small numbers. When one number passes from paper to another, the sandpaper turns 900°C. Grinds are sanded in one direction until the lines disappear from the surface. Various reagents are applied to the slides for the appearance of the macrostructure. Under the influence of various reactive solutions, the appearance of the internal structure is formed on the surface of the macroslides. The macrostructure of metals and alloys is studied under a magnifying glass or MIM-3, MBS-2 microscope. We will consider in detail the types of fracture and wear, including viscous, brittle, and the causes of fatigue fracture [2].

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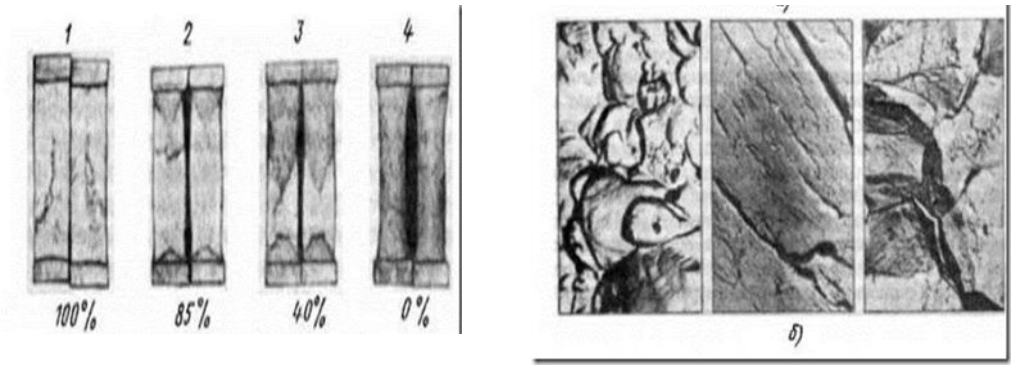
Fracture microanalysis. According to the method of macroanalysis, that is, viewing the external fracture surface, one system can contain different alloys. For example: In steel and white cast iron, all the carbon is bound by stementite, while light tines, gray, malleable, and very refined cast irons are dark in color due to the presence of graphite. According to their nature, cracks can be divided into 2 main types: brittle or viscous and mixed, which are parts with viscous and brittle cracks (Fig. 1).

Research part

Microscopic analysis is a method of studying the internal structure of materials, examining the internal structure of separately prepared metal samples using an optical microscope (Fig. 1). The appearance of the internal structure of metals and alloys using optical microscopes is called microstructure. Microscopes are used to divide metals into the required larger, better, clear all-participating phases or type of materials, their number, shape and internal structure; white and usual optical systems, glass lens and prism called colebinastia (optical microscopy); It is necessary to adopt electrostatic and electromagnetic lenses in the optical system (electron microscopy). Adoption of different light scattering and different construction microscopes (optical and electron), these are images that show special preparation, object and basic methods of deciphering depending on the specific purpose[3].



a) b)

Figure 1. Brittle fracture of steel: a - types of fracture; 1 - fragile; 2 and 3 - mixed; 4 - sticky;b microfactograms of viscous (cup), brittle (grooved), intercrystalline brittle fractures (from left to right) (X6000)

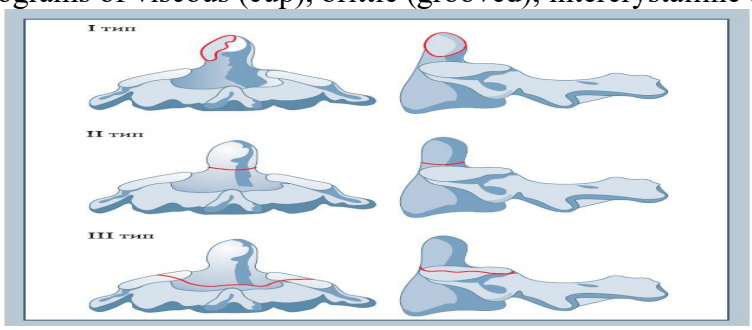


Figure 2. I - oblique fracture of the peak (apical part) of the arrow tooth; II - fracture of the neck at the junction of the tooth with the body of the arrow; III - fracture axis at the base of the tooth in the body.

Types of mechanical fracture.

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The main mechanical properties of metals include strength, hardness, elasticity, impact viscosity. Durability is the ability of a metal to resist decay or residual deformation under the influence of forces. Relative strength is of great importance, it is found as the ratio of the strength limit to the density of the metal. The tensile strength of steel is greater than that of aluminum, but the relative strength is smaller. Hardness is the ability of a metal to resist deformation of its surface under the influence of a body harder than itself. Elasticity is the property of a metal to return to its original shape after the impact of force is stopped. Impact toughness is the property of a metal to resist erosion due to dynamic forces (Fig. 3).

Among all types of fracture: Intercrystalline brittle fracture, fatigue fracture, crack on the surface of the distance ring, the nature of the crack on the surface, the appearance of fracture of the impact sample are shown in Figures 2.4, 2.5, 2.6, 2.7, 2.8, 2.9, 2.10 [4].

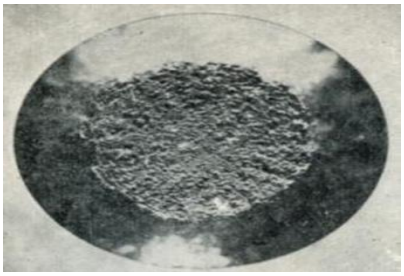

Figure 3. Viscous fracture Fig. 4. Intercrystalline brittle fracturering. increased by 3times

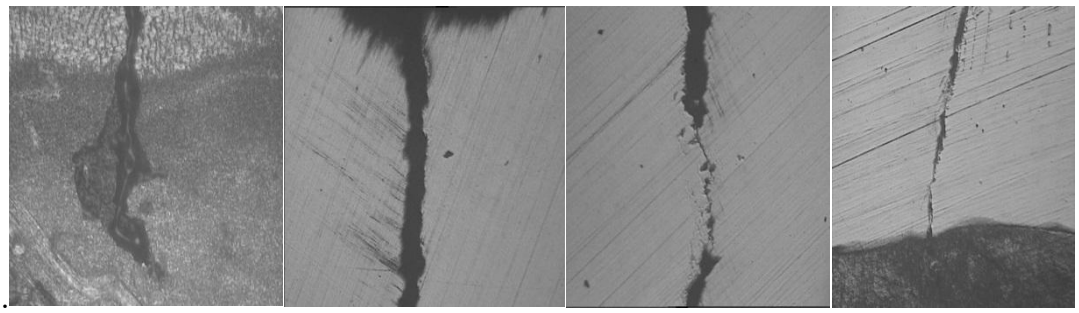

Figure 6. The nature of the surface crack.

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Figure 7. Fracture view of impact specimen. increased by 6times

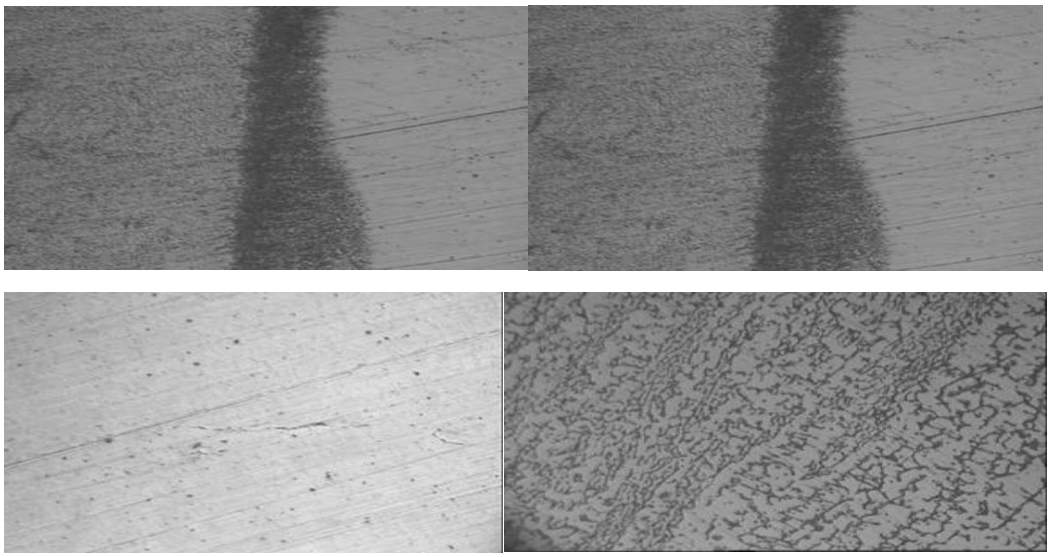

Figure 8. OM microstructure - 6 times hardening

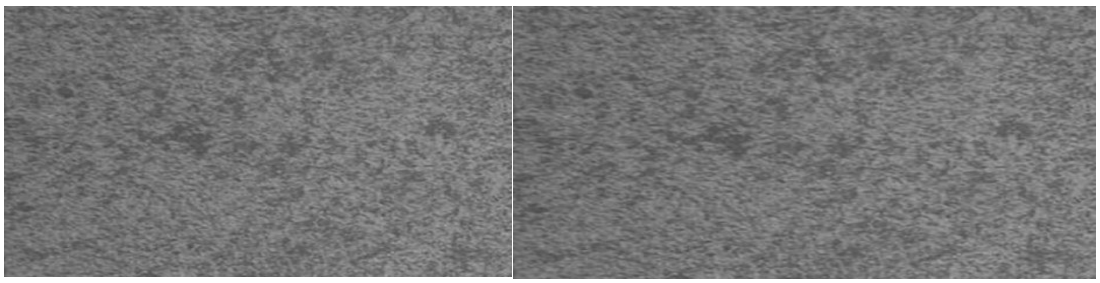

Figure 9. Microstructure images of OM.

Corrosion and oxidation of metals by abrasive friction.

The erosion of metals by abrasive friction is called metal erosion. Mechanical energy is converted into heat energy when metals are eroded by friction. The metal heats up. Abrasive processing - mechanical processing of metals, glass, wood and other materials using abrasive tools. Abrasive processing includes grinding and polishing, honing, rubbing, sharpening, sizing, and other methods. Oxidation of metals occurs in 3 environments 1. Atmospheric corrosion. 2. Underground corrosion. Corrosion of underwater environment. Metals corrode at different rates under the influence of the surrounding environment. The main reason for this decay is the spontaneous decay of the metal surface as a result of chemical interaction with the external environment, which is called corrosion (lat. Corrodere - self-decay).

There are the following types of corrosion: Chemical corrosion, electrochemical corrosion, corrosion in gas environment, corrosion in atmospheric environment, underground corrosion, biocorrosion, contact corrosion, radiation corrosion, fretang corrosion, intercrystalline corrosion, corrosion inside cracks [5]

1. Chemical corrosion - in this process, the oxidation of metals in a corrosive environment occurs simultaneously with the reduction of the oxidizing component. Interaction environments are

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not separated by space. 2. Electrochemical corrosion - in this process, the metal is in a corrosive environment (electrolyte solution) effect does not take place at the same time, the rate of reduction of metal atoms and the oxidizing component differs from each other and depends on the electrode potential. Corrosion is divided into several types according to the environment: 3. Corrosion in a gas environment is a chemical corrosion process that takes place at a minimum level of humidity (usually 0.16c) or at high temperatures. 4.Corrosion in atmospheric environment - corrosion in atmospheric air or all moist gases. 5. Underground corrosion is the corrosion of metals in soil and ground environment. 6. Biochemical corrosion - corrosion due to the life activity of microorganisms. 7. Contact corrosion - contact corrosion under the influence of different potentials in an electrolyte. 8. Radiation corrosion - corrosion caused by radioactive radiation.Corrosion under the influence of external current and Foucault current. External current corrosion is corrosion caused by an external source current, Foucault current corrosion is corrosion caused by "daisy" currents. Stress corrosion - this type of corrosion is caused by the influence of a corrosive environment and mechanical stresses. If there are tensile stresses, the metal may split. This type of corrosion is very dangerous, especially for structures that are under mechanical stress (shafts, springs, steam boilers, turbines, etc.). 9. Fretting creates a corrosive environment under the influence of corrosion-vibrations. Prevention of this type of corrosion is achieved by the correct selection of the structure or the correct calculation of the level of vibration. Coating with various coatings to reduce the coefficient of friction also gives a good result. If the surface of metals is completely oxidized, it is called full coverage corrosion. Fully covered corrosion is uniform and the rate of oxidation is uniform. If some parts of the metal surface are uneven, the corrosion process will occur at different speeds[6]. 10. Intercrystalline corrosion - mainly occurs in stainless calcium, chromium, chrome-nickel steels, nickel and aluminum alloys. In this case, the boundaries of metal grains are oxidized and their connections are reduced. This type of corrosion does not affect the appearance of the metal and eats the metal from the inside. This type of corrosion is very dangerous and the metal loses its strength and plasticity. 11. Corrosion between cracks - mainly occurs at the junction of two parts, develops between deposits, grooves, due to the fact that metals have different electrode potentials.

Reagents used in macroanalysis.

The macro sample is exposed to a mixture of 10-15% sulfuric acid with a mixture of copper ammonium salts in water. The following are the main reagents used to reveal the macrostructure of metals and alloys.

1. Solution of chromium in sulfuric acid,

Chromium (K2S2O7) – 25 g, Sulfuric acid - 60 ml, Pure water - 500 ml.

This determines the direction of the reactive steel fiber. The reagent is exposed for 1-3^{o}C in an undesirable state. Then the macro sample is cleaned and washed with running water.

2. Vagapov jet; 50 ml of a 50% solution of nitric acid in water.

3. Heine's reagent: this reagent detects the uneven arrangement of phosphorus, carbon. The reagent is used in an unheated state, while the surface of the sample is immersed in the reagent for 2-3 minutes, then the formed copper layer is gently washed with running water or with a moistened cotton. After that, in order to protect the clean surface from rapid oxidation by air, it is covered with filter paper and kept until it dries.

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Ammonium chloride - 53 gr, Copper chloride - 85 gr, Water - 1000 ml

Bauman's method. (testing for sulfur) sulfur is the most harmful compound in steel, and it is strictly limited in GOSTs. Sulfur is found in steel as FeS, MnS sulfides. Photo paper containing silver bromide is soaked in a solution of 5% sulfuric acid in water for 5-10 minutes in normal light. Then excess acid on the surface of the drawing paper is removed using filter paper. The drawing paper is covered with the emulsion side on the prepared surface of the macro sample and held for 2-3 minutes. As a result, the following chemical reactions take place between silver bromine, sulfuric acid and sulfates included in the picture emulsion.

$FeC + H_2SO_4 = H_2C + FeCO_4$, (1) $2AuBr + H_2C = Au_2C + 2HBr$ (2)

The formation of Au2S brown spots on the surface of the paper indicates the form and distribution of sulfides (sulfur). After holding the silver bromide paper on the surface of the sample for a certain time, the photo paper is separated: it is washed in water and thrown into a 25% aqueous solution of hyposulfite to strengthen the resulting stain. [2]

Such a sample surface is called a macroslice. The macrostructure of cast metal is dendrite structure. When the cast metal is pressed, the dendrites stretch and form fibers. Depending on the metal macrostructure, it is possible to determine the degree of deformation and the direction of the fibers. It is possible to find out the homogeneity of the metal, internal defects (cracks, inclusions, pores, etc.) using special rusting methods. The macrostructure inspection method is used in industry. The radiographic method is used to determine the X-ray structure of metals. This method is based on X-ray diffraction of a number of atoms in a metal crystal lattice. [1]

Conclusion: For the analysis of general information about metallographic analysis, equipment, tools, samples and materials needed to pass the work: Lathe, cutter, electric wheel, samples of various metal alloys, polishing papers, reagents and drawing papers, metallographic microscope for observing prepared micro-samples, metallographic microscope for observing prepared micro-samples Procedure:

1)Each student from the group takes two samples to prepare macro and micro samples; 2)To smooth the surface of the sample, it is carried out in a strictly straight plane and in the place where the necessary numbers of polishing paper are available; 3) After polishing, the student cleans, washes and dries the sample; 4) Samples made of steel are exposed to the reagent. The macro sample is exposed to a mixture of 10-15% sulfuric acid with a mixture of copper ammonium salts in water. The microsample is exposed to a 4-5% solution of nitric acid in ethyl alcohol. Exposure time is 3-6 seconds; 5) After exposure to the reagent, the samples are washed in water and dried with filter paper. The internal structure of the prepared samples is studied using optical microscopes. The order of writing the report: the subject of the practical work, the purpose of the work, methods of preparation of macro and micro samples and conclusion. Control questions:

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