TESTING OF STRUCTURAL STEEL MATERIALS BY ROCKWELL AND VICKERS METHODS.

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Abstract. The article discusses the issue of testing structural steel materials by the Rockwell and Vickers methods.

Keywords. Steel, Rockwell, Vickers, metal hardness, crystal lattice, kinematics, copper, aluminum, titanium, steel, cast iron.

Introduction. The hardness of a metal is the ability of a given material to withstand the penetration of bodies harder than it into the outer layers of its crystal lattice. In other words, it is a characteristic property of this material to resist any deforming effects inherent in it.

The hardness of a metal is determined by impacting the sample being tested on another solid object - an indenter. As an indenter, a sphere made of a material with very high hardness and a cone or pyramid cut from a diamond are used.

The impact of the indenter on the test sample is carried out with a certain force, as a result of which an indentation remains on the sample, the depth of which and other parameters determine the hardness of the test material. However, this is not the only way to determine it. Most often, dynamic, static and kinematic methods are used to determine hardness:

Ferrous metals and alloys. This category includes steel (carbon, alloyed), ferroalloys, as well as cast iron. This category also includes vanadium and manganese. Among ferrous metals, steel has the greatest hardness.

Method. Determining the hardness of a metal depends on the method by which the measurements were made. Even the signs of hardness designations vary. In addition, this parameter is not part of the generally accepted system of units, therefore it is not included in a single standard for designations.

In the Rockwell method, one division corresponds to the movement of the standard cone by 2 microns (μm) into the depth of the material being tested. The designation involves the initial writing of the index, then one of the letters (A, B or C) and then a numerical value (if the hardness of the metal in the workpiece is indicated as HRB, then these are Rockwell units of measurement).

A - a diamond cone with a 1200-point angle is used in the test, and the applied load is in the range of 50-60 kg.

B - the pressure is exerted by a ball with a diameter of 1.59 mm, the pressure on the surface is 90-100 kg.

C - a diamond cone is used, but the pressure is 140-150 kg.

The hardness of metals is indicated as a number after the letter, which is a characteristic of the depth of the indentation.

In order to quickly determine the hardness of a workpiece before thermal or mechanical treatment, such an indenter hardness tester was invented by Hugh and Stanley Rockwell. In this method, the tip of the tool for measuring the hardness of a metal is made of steel or diamond. The results of assessing the hardness of metals according to Rockwell are shown in eleven scale tables (with letter designations from A to T). The tip of the indenter is made of diamond with a circular shape at an angle of 1200 or is made of tool steel or tungsten carbide with a spherical shape.

The loads used in the Rockwell method are 60, 100 or 150 kgf. Of course, it makes no sense to apply too much pressure to soft metals, so the softer the sample, the lower the pressure.

Result. Determination of the hardness of a metal by the Vickers method is carried out on the basis of ISO6507. This test involves the use of an indenter in the form of a diamond pyramid with an angle of 1360. The usual designation for this research method begins with “HV”. This is followed by a numerical value obtained by dividing the load by the area of the cone trace. Vickers hardness is determined for thin-walled samples, as well as for materials that have undergone nitriding or cementation. During the study, the load is applied for at least 5 seconds.

Discussion.

1. The sample or part to be tested is placed on the instrument table with the cleaned side of the surface facing up.

2. The corresponding tripod is installed in its place.

The sample is placed on the support surface and the hardness measurement method is selected on the instrument screen (Vickers). The Start button on the screen is pressed, then the electric motor is started. The diamond pyramid is immersed in the sample for a certain time.

3. After the sample has been held under load for a period of time (usually 10-30 seconds), the Vickers hardness will appear on the screen.

Conclusion. Testing structural steel materials using the Rockwell and Vickers methods ensures that the performance requirements imposed on them are met.

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