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Research Article

STUDY OF PHYSICAL AND MECHANICAL PROPERTIES OF PETROLEUM BITUMEN

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ABSTRACT

The article presents the results of scientific research on the use of bitumen compositions developed on the basis of raw materials and wastes of domestic oil, gas and petroleum industry in the production of new types of construction waterproofing materials, as well as on the determination of their physical-mechanical and operational properties.

KEYWORDS

Ingredient, modifier, bitumen, technology, bituminous compositions, physical-chemical, technological, physical-mechanical properties, operational properties, oil, gas, raw materials, waterproofing material, secondary raw materials, construction bituminous composition on the basis of.

INTRODUCTION

Creation of waterproofing materials with high performance characteristics in the world, creation of new ingredients and modifiers for obtaining bitumen compositions and improving their properties, study of their physical and chemical properties, development of bitumen modification technology, physical and chemical, technological, physical and mechanical and research works. is carried out in order to determine the performance properties and use of the material "Polyisol", obtained on the basis of developed bitumen compositions, in industrial constructions In this connection, including determining ways of obtaining the waterproofing material "Polyisol" on the basis of bituminous composition developed from raw materials and wastes of the local oil, gas and petroleum industry, to determine the physical, mechanical and technological properties of the construction bituminous composition obtained on the basis of secondary raw materials, to obtain the created waterproofing material is important development of technology.

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MATERIALS AND METHODS

Laboratory quality control of bituminous binders was carried out in accordance with GOST 6617-2021 "Bitumen construction oil-containing" [1].

Stretchability (plasticity) - the ability of bitumen to stretch into a string: it is measured by the length of the string when it is broken. This characterizes its plasticity and deformation.

The principle of operation of the device is based on determining the maximum length to which bitumen can be stretched without breaking it, this process is carried out in a special device that is stretched at a constant rate at a certain temperature. Preparation of bitumen samples for testing was carried out according to GOST 22245-90. Bitumen molds are stored for 60 minutes at a temperature of (25±0.5)°C or (0.0±0.5)°C. Bitumen samples for testing at (0,0±0,5)°C are made by adding ice to the bath of the testing unit to maintain the specified temperature. After 60 minutes, the bitumen molds are removed from the water, removed from the plate and mounted on a ductilometer[2].

Poured into a standard mold bitumen samples are placed on stands and carts in a water bath with a temperature of (25±0.5)° C or (0.0±0.5)° C and at a temperature of (5.0±0.25) cm/min quickly. stretched. At the moment of bitumen sample column rupture, the arrow of the manometer scale is visually recorded [3].

When the temperature of viscous bitumen binder increases by 5 °C, its viscosity necessarily changes, so one of the standard methods of determining the depth of needle penetration - penetrometer of the laboratory device will help us. Depending on the depth of penetration of the needle of the laboratory device penetrometer can determine the brand and type of bitumen.

Before using this device, a bitumen sample is taken and a needle is lowered into the sample under a certain load (50 g, 100 g and 150 g) according to the requirements of GOST and the depth of penetration in the bitumen sample. measures several parameters[4].

According to the analysis of many scientists, the depth of penetration of the needle depends on the amount of asphaltenes in bitumen, that is, with the increase in the amount of sulfur in the composition of bitumen increases the amount of asphaltenes, which reduces the depth of penetration.

Viscosity (permeability) of bitumen is determined by the depth of penetration of the needle into the bitumen sample under a load of 1 N for 5 s at a temperature of 25 ° C using the device "Penetrometer" (Fig. 1).

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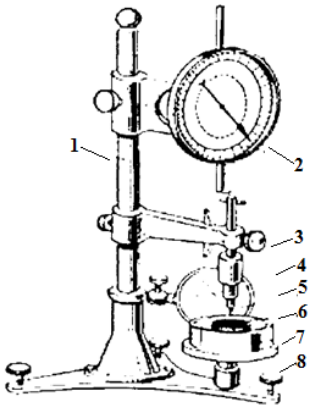

1 - tripod;
2 - scale;
3 - stop;
4 - glass;
5 - needle;
6 - bitumen sample;
7 - crystallizer with water;
8 - base

Figure 1. Penetrometer

In accordance with GOST requirements, the sample of viscous bitumen binder is dehydrated and melted, poured into a special metal beaker 30 mm high, cooled for 1 hour at T=18-20°C and placed in a bath with water temperature 25°C 1 hour before the study. Then the sample is transferred to a crystallizer with water (T=25°C) and placed on the penetrometer table.

The laboratory instrument penetrometer helps us to determine the value of penetration index. On this laboratory device are carried out according to the requirements of GOST in each experiment, only because the number of samples is not limited, readings of the depth of penetration of the needle are recorded every five seconds and their average values are determined[3]. The values of needle penetration depth into the bitumen sample in the device are recorded and calculated as the temperature level increases from 0°C to each level.

In order not to deviate from the standard requirements, the values of variance of the needle penetration depth determination results are determined and compared.

There are two widely used methods for determining the softening temperature. There are two widely used methods for determining the softening point. One is the "Ring and Ball" method and the other is the Kremer-Sarnow method. In both methods, a sample of petroleum bitumen in containers of a certain shape is slowly heated in a thermostat. When the sample is heated, a force of a certain magnitude is applied to it [4].

The softening temperature of bitumen is taken as the temperature at which the sample is visibly deformed. But this temperature, found in practice, is relative, and its value depends on the way of conducting experiments. Usually. The softening temperature found by the Ring and Ball method is about 10 oC higher than that of the Kremer-Sarnow method. It should also be noted that these methods determine the softening temperature of oil products with low molecular weight, because with increasing molecular weight of oil and oil-containing substances decreases the possibility of its transition to the liquid state. [5].

The instrument used in the Ring and Ball method consists of two cups placed one inside the other. The

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outer glass plays the role of a thermostat. Its height is 15 cm and its diameter is 12 cm. Glycerine is placed in it to a height of 5 cm. The diameter of the second glass is 9 cm and a brass tripod is placed inside it (Fig. 2).

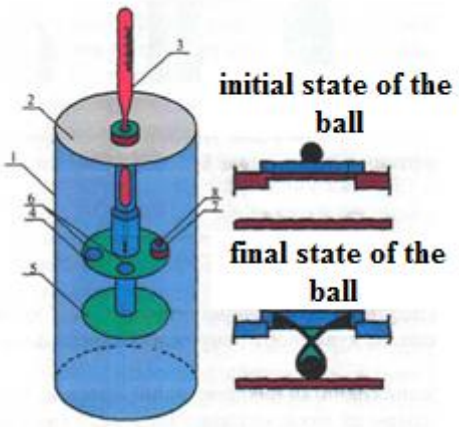

Figura 2. General view of the device determining the softening temperature of bitumen by the "ring and ball" method

1-cup; 2-cover; 3-thermometer; 5-top plate; 5-bottom plate; 6-hole; 7-link

Under it and above it the plates are glued. The upper plate (1) has three holes, in two of which the rings (5) are installed and in one of them a thermometer is located. Above the "Rings" are the "Balls" (3). The bottom plate (2) is positioned so that the glass will not break when the ball drops. The balls have a mass of 3.55-3.55 g and a diameter of 9.53 mm. The inner diameter of the ring is 15.875 mm, height 6.35 mm, thickness 2.25 mm. The tripod on which the plates are mounted is attached to a brass lid. The distance between the rings on the plate is 2.55 cm[5].

To prepare the sample, the rings are placed on a flat surface and poured with liquefied petroleum bitumen. If the petroleum bitumen overflows, the excess is cut off with a heated knife. The ball is then placed on the cooled petroleum bitumen and the ring is placed on the top plate (1). The rack is placed in a glycerol bath and heated at a rate of 1°C per minute. When the oil bitumen liquefies, the ball hangs up and touches the bottom plate. This temperature is the softening temperature of the oil bitumen [5].

Once the bitumen is heated, the temperature at which the combustible gases released from the composition ignite in the room atmosphere is called the flash point.

RESULTS AND DISCUSSION

Determination is carried out in an apparatus with a large crucible 5, filled with sand, heated on a burner, and a small crucible 4, filled with molten bitumen so that its level does not reach 12 mm from the edge of the crucible. For bitumen with expected flash point up to 210 ° C and 18 mm for bitumen above 210 ° C [6].

Thermometer 3 is placed in a small crucible in a vertical position, with the mercury ball in the center of the crucible. The large crucible is heated for one minute 6 with a gas burner flame with a heating mode of 10°C.

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40°C. Before the expected flash point, the heating rate is reduced to 4°C per minute. Up to the expected flash point of 10°C, light the apparatus and run it slowly around the edge of a small crucible at a distance of 10-14 mm from the bitumen surface. The length of the flame should not be less than 3-4 mm. The appearance of a blue flame on the surface of bitumen is considered the moment of its ignition, and the temperature recorded at this time - the flash point [6].

CONCLUSIONS

Thus, as a result of the conducted researches the optimal composition of building bitumen composition with new composition on the basis of oil sludge, gossypol resin, technical sulfur and quicklime with high operational properties was developed. The function and mechanism of interaction of components of construction bituminous composition with a new composition have been determined.

It is established that the developed waterproofing material "Polyisol" has positive indicators of physical and mechanical properties, i.e. linear size, strength limit, results of flexibility at -13.5°C, water absorption and water resistance, mass loss at Heating and heat resistance.

The technology of production of waterproofing material "Polyisol" based on construction bitumen of a new composition has been developed.

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