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MEASURE THE MOISTURE CONTENT OF SOLID AND ABSORBENT MATERIALS

Annotation: methods for measuring the moisture content of solid and soluble materials are conditionally divided into several groups. High measurement accuracy, but the long duration of the measurement process (up to 10-15 hours), is a characteristic feature of measuring humidity by indirect methods. Indirect methods are characterized by very high speed execution, as well as low measurement accuracy. In technical measurements, almost all time indirect methods are used. Conductometric, dielpkometric (capacitive), ultra-high repeatability, and optical methods are common in indirect moisture measurements.

Key coils: humidity, measurement, conductometric, dielpkometric (capacitive), ultra-high repeatability and optical methods.

Introduction

Methods for measuring the moisture content of solid and fissile materials are conditionally divided into two groups [1]:

1) direct methods that allow you to determine the mass of a wet or dry substance in the sample (drying, extractive and chemical methods);

2) indirect methods that determine moisture by measuring the Associated parameter (conductometric, dielkometric, ultra-high-repetition, optical, nuclear magnetic resonance, thermovacuum, teplophysical methods).

High measurement accuracy, but the long duration of the measurement process (up to 10-15 hours), is a characteristic feature of measuring humidity by indirect methods. Indirect methods are characterized by very high speed execution, as well as low measurement accuracy. In technical measurements, almost all time indirect methods are used. Conductometric, dielpkometric (capacitive), ultra-high repeatability and optical methods are common in indirect moisture measurement [2].

Materials and methods

This includes empirical methods such as modeling, fact, experiment, description and observation, as well as theoretical methods such as logical and historical methods, abstraction, deduction, induction, synthesis and analysis. The research materials are: scientific facts, the results of previous observations, surveys, experiments and tests; means of idealization and rationalization of the scientific approach.

Many of the materials commonly used in industry are capillary-porous rocks in which water is stored in pores. The amount of moisture the Material can absorb depends on the shape, size and location of the capillaries, as in the case of the nature of the water binding to the material. Since moisture-dependent graded descriptions of solid and soluble materials are not always sufficient, there are certain complications in measuring their moisture content. Capillary-porous materials are dielectric substances with a specific resistance of 108 Om/m and higher in their dry state. Capillary-porous materials can become conductors with a specific resistance of 104 Om/m when moistened.

Conductometric moisture meters are widely used in measuring the moisture content of solid and absorbent materials. The conductometric method is based on the connection between the moisture content of a substance and its electrical resistance. This connection is expressed as [2]:

Results and discussion:

By the conductometric method, capillary-porous materials are measured with high accuracy in their moisture content by means of interleaved proportions of their moisture with electrical resistance. The conductors of conductive moisture meters consist of two electrodes, which are processed in the form of flat plates, cylindrical tubes, wheels, etc. But the complex dependence of resistance on other factors (temperature, density of the material, chemical composition, the presence of electrolytes in it, etc.) does not give the opportunity to automatically and without proper measurement of moisture in a conductometric way. Therefore, the range of use of conductometric moisture meters is limited [2,3].

Among measurement schemes, the most effective are bridging schemes. Bridged measurement schemes have a high sensitivity with moderate to high (5 ... 25%) is used in moisture measurement, Figure 1 shows the principle scheme of an automatic moisture meter with a bridge measurement scheme.

The material being examined is passed between the wheelbarrow and the juva (the wheelbarrow is insulated from the Juva). The main element of the chain is the bridge, the R4 and R5 sails of the bridge are constant resistors, and the other two sails are internal resistors of the double triode (the scheme has two additional resistors R1 and R2). Along the diagonal of the bridge, a millivolptmeter is connected. The Uc negative voltage in the left-half lattice of the electron lamp is determined by a decrease in the voltage at the resistance Rx and is constant. Therefore, the resistance in the left half of the triode is also constant. The negative stress on the right triode lattice varies from Us to IR6 magnitude. J electric current, on the other hand, depends on the RX resistance of the material being viewed and the state of the R2 reochord slip. The reochord slider is moved from the zero position of the millivoltmeter shaft (the bridge muvonazate is broken) with a voltage drop at R2 until the voltage drop at R6 and R7 balances between them [2] .

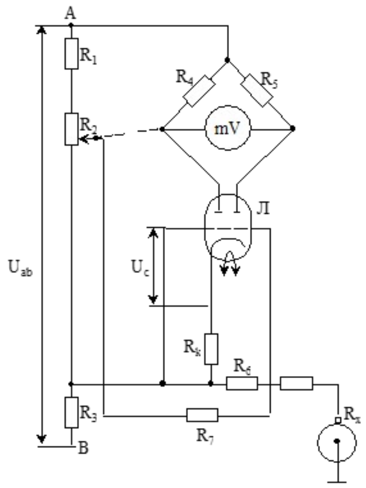


Figure 1. Automatic moisture meter with Bridge measurement scheme

The dielcometric method is based on the fact that with a change in the moisture content of capillary – porous bodies, dielectric absorption in them also changes. The dielectric refractive index of dry bodies ye is typically 1 to 6, while that of water is 81. The change in dielectric absorbency caused by the change in the moisture content of the material is usually determined by the change in capacitor capacity in which the material being analyzed is placed between the coatings. The dielectric moisture meter Switch is made in the form of two flat plates or two concentric cylinders, and between them is filled with the material being analyzed. When the geometric dimensions are known, the capacitor capacitance can be expressed by the formula:

$$S = K \cdot \varepsilon, \qquad (2)$$

where: K is the geometric dimensions of the capacitor, a constant that is determined by the shape; a dielectric absorbance that is determined by the moisture content of the flux - material.

Ultra-high-repetition (etching) moisture meters use a considerable (tens of times) difference in the electrical properties of water and dry matter. The moisture concentration is measured according to the attenuation of high-repeat radiation passing through the layer of the material being analyzed.

Determination of the moisture content of substances in the ultra-high-repetition (etching) method is carried out in the field of ultra-spectrum radio waves (3000 ... 10000 MHz) is based on the fact that the electrical properties of materials depend on the humidity in them. The structure scheme of oyut moisture meters is depicted in Figure 2 [4].

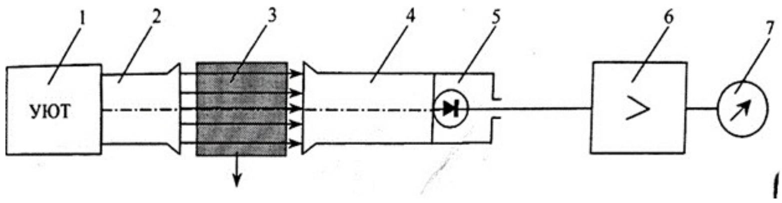
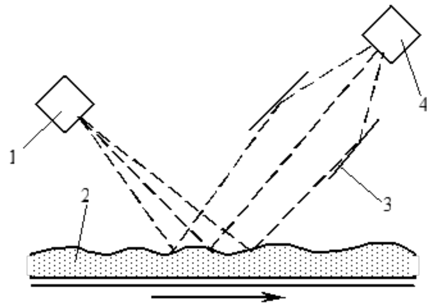


Figure 2. Structure scheme of ultra-high-repetition moisture meter: 1-Groove generator; 2 – absorbing antenna; 3 – material under investigation; 4 – receiving antenna; 5-receiving detector; 6-amplifier; 7-measuring instrument

The material being examined passes between the host antenna 2 of the 3-Groove generator (1) and the receiving antenna 4. The receiver receives a weakened signal of antenna 4 and detector 5 Oyut li radiation, and the amplifier 6 switches to the measuring instrument 7.

Optical moisture meters use a bond between the moisture content of a substance and its light absorption property (Figure 3).



3-rasm. Optik namlik o`lchagich: 1 – nurlanish manbai; 2 – namligi tekshirilayotgan material; 3 – qaytgan nurlar; 4 – nur qabul qilgich

The axial li method is contactless and inertial, and is less sensitive to uneven distribution of moisture between particles in scattering materials than other existing electrical methods. The extreme complexity of the structure of the tool is the main disadvantage of Groove moisture meters. In addition, these instruments require constant density levels or density information of the material being controlled. Oyut li moisture meters 0 ... Allows you to measure humidity with high accuracy in a wide range of 100%.

Conclusion:

To achieve high measurement accuracy, such instruments use rays of the light spectrum in the infrared area. Infrared light is sent through Source 1 to a material 2 whose moisture is being detected, while 3 Rays returning from the material are recorded at receiver 4. (Figure 3). The greater the moisture content of the material, the better it absorbs infrared light, and the lower the amount of Return current [1].

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