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# EVALUATION OF THE QUALITY OF MULTIFUNCTIONAL COATINGS AND SELECTION OF BASIC REQUIREMENTS TO ENSURE OPERATIONAL RELIABILITY

**Egamnazarova Fazilat Dostqobilovna**

**A B S T R A C T**

A lot of work is being carried out on the selection of research objects for the creation of effective organomineral materials and multifunctional coatings based on them using local raw materials. Production of high-quality coatings is a requirement of time.

**K E Y W O R D S**

Paint, varnish, coating, electrolyte, insulation.

Paints and varnishes are used to protect the outer and inner surfaces of steel vessels.

Requirements for paints and varnishes. Normative documents regulate requirements for external and internal coatings. Regardless of which surface of the layer is used, first of all, requirements are set for its appearance. Appearance is determined visually using a 4x magnifier and ruler.

The coating should be applied evenly, without gaps or visible defects. A defect in the coating is very dangerous: the surface of the defect in contact with the medium (electrolyte) becomes an anode with a small area. The insulated surface serves as the cathode. Under these conditions, due to the incomparable difference in the areas of the anode and cathodic sections, the anode current density is very high and a sharp localized corrosion attack develops in the uninsulated section. Requirements for the assessment of the appearance of coatings are regulated [69: 12c].

Localized corrosion damage (gastric ulcer) may also occur in areas with low adhesion of the coating to the metal. Insufficient adhesion leads to partial delamination of the metal, leakage of electrolyte under the cleaned insulation (atmospheric moisture or produced water) and activation of the anode process in the area with cleaned insulation. Therefore, the next requirement for coatings is high adhesion to the metal surface. The adhesive strength of the coating is determined in three different ways: by the X-shaped scar method, by the grid step method, and by determining the decrease in adhesive strength by the peeling method [70: 16s].

The adhesive strength of the coating is evaluated by the delamination and flaking of the cell squares. The essence of the peeling method is to determine the viscosity by peeling the flexible plate from the glass-reinforced coating and measuring the force required for this with a viscosity meter. Both visual inspection of the coating condition and adhesion evaluation are performed in the initial state and after various exposures to the coated metal.

Such exposure can be aging for 1000 hours at 60°C, prolonged exposure (up to 720 hours) in a humidity chamber at 40°C and in a salt fog chamber, testing in a very aggressive environment, etc.

After the tests, the condition of the metal under the coating is evaluated: there should be no traces of corrosion damage on its surface.

Since there are no completely continuous coatings, the thickness of the coating must be sufficient to prevent perforations in it. Through holes, like other defects, local damage to the metal of the reservoir can occur. The number of holes can be significantly reduced with multi-layer coatings. Therefore, the thickness of the coating is regulated, which is determined using a magnetic thickness gauge. The requirements for this are determined by the recommendations of the coating manufacturer.

Along with pipe linings, tank linings must actively inhibit the step of transferring charges from the anode to the cathodic parts through the electrolyte. The properties of a coating's barrier properties are its dielectric continuity and durability.

The resistivity of the coating is determined by the current in the metal coating system after holding the samples in a 3% NaCl solution.

During operation, tank linings are exposed to the chemical effects of atmospheric moisture, aggressive oil components, produced water and detergents. Therefore, requirements for resistance to these environments are imposed on coating materials. The coating should be characterized by low moisture absorption (not more than 3% at 20°C and not more than 6% at 60°C), which is defined as the relative increase in the mass of the coated sample after a certain period of storage. time in distilled water [71: 12s].

Evaluation of the resistance of the coating to the effect of produced water is carried out by viscosity, mechanical properties and appearance of the coating after testing in 3% NaCl solution for 1000% at temperatures of 20%, 40 and 60 °C. Resistance to light petroleum products is evaluated by changes in appearance, viscosity and mechanical properties after 40 consecutive short (10 minutes) tests in humidity, sulfur dioxide, cold rooms and a chamber with a simulated petroleum product.

Resistance to detergents is evaluated by the change in the same properties of the coating after exposure to detergent for 6 hours.

The next set of requirements regulates the mechanical properties of coatings. During operation, the walls of the reservoirs undergo significant deformations: when oil is poured into the tank, it becomes a barrel, and when it is discharged, it becomes a cylinder.

Therefore, in order not to collapse under significant deformations, coatings must have high elasticity and flexibility. In the assessment of elasticity, a coated plate is bent around a cylindrical metal rod. The value of the elasticity of the coating is determined by the minimum diameter of this rod, which does not cause mechanical destruction of the painted metal plate or peeling of the paint film. The plasticity of the film is determined by the standard tensile method [72-74].

During operation, individual elements of the tank may rub. Therefore, the coating must be wear-resistant. The latter is determined in an abrasive machine, in which the sample is rotated and exposed to an abrasive. In addition, the coating must be sufficiently rigid and, like pipeline coatings, its strength is increased so that its durability does not break under mechanical stress.

When a defect appears on the metal surface, for example, a corrosion pit, a pit or simply mechanical damage, the situation changes radically. At the peak of the defect, a concentration of stresses is formed, the level of which may exceed the permissible level for a given metal structure.

This concentration of stresses at the tip of the flaw causes the development of local plastic deformation, even at low average working stress. Exhaustion of the possibilities of this deformation leads to destruction. The development of local plastic deformation at the base of the moving crack should be considered as the first stage of fracture.

This energy-absorbing deformation limits the rate of cracking and may even slow it down. If the crack reaches some critical dimensions characteristic of the given conditions, the second stage of fracture begins. This is a landslide, the growth of uncontrollable cracks. It proceeds with virtually no plastic deformation and eventually leads to destruction of the metal structure.

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