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RESEARCH ON THE CONSTRUCTION TECHNOLOGY OF REINFORCED MONOLITHIC POLYMER-COATED FLOORS AND IMPROVEMENT OF PRODUCTION TECHNOLOGY

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Annotation: This research work highlights the issues of construction technology and the improvement of production processes of reinforced monolithic polymer-coated floors. Polymer–cement concrete, polyvinyl acetate mastic (“Pavilit”), mastics based on polymer dispersion, and their physico-mechanical properties (strength, hardness, water absorption, disintegration, elasticity) were analyzed. The main advantages of polymer coatings-hygienic quality, resistance to wear and impact, aesthetic appearance, and long service life-were demonstrated. At the same time, some shortcomings of existing coatings, in particular low impact resistance, were identified, and prospects for strengthening them through reinforcement with chopped glass fibers were substantiated. The proposed technology is considered an effective solution for the construction of floors in industrial and public buildings, serving to create high-quality and economically efficient floor coatings in the construction sector.

Keywords: Reinforced polymer-coated floors, monolithic polymer coatings, polymer-cement concrete, polymer mastic, polymer dispersion, polyvinyl acetate mastic, Pavilit mastic, chopped glass fibers, reinforcing materials, metal mesh, synthetic polymers, polymerization, polycondensation, copolymers, polymer–cement mixture, physico-mechanical properties, strength, water absorption, disintegration, hardness, elasticity, construction technology, seamless floor coatings, impact resistance, crack resistance, gypsum–aluminous cement, mastic compositions, leveling layer, surface layer, localization, modernization, machine-building plant floors, floors under transport loads.

Introduction: Thanks to independence, the economy, industry, agriculture, and culture of the Republic are developing year by year. Especially in recent years, significant changes and reforms have been implemented in the field of construction. On the initiative of the President of the Republic of Uzbekistan, Shavkat Mirziyoyev Miromonovich, large production enterprises, beautiful and luxurious residential buildings, cultural and public facilities, modern schools and hospitals, attractive bridges, and modern roads are being built. Within the framework of the “Strategy for the Development of the Construction Materials Industry until 2025” announced on February 15, 2024, specific tasks were defined for the localization of the production of construction materials, the introduction of modern technologies, and the increase of export potential. It is known that the technologies produced in our country are several times cheaper and economically more feasible compared to foreign technologies. Monolithic coated floors have begun to be widely used, especially in the construction of industrial buildings. One of the promising types of such floor coverings is mastic-based compositions. They are technologically convenient, inexpensive, and durable. However, the disadvantage of such floor coverings is that they are not very resistant to impact forces. Therefore, they need to be reinforced with materials such as metal meshes and glass fibers.

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Main part: Synthetic polymer materials currently occupy a strong position in construction. Polymers are collections of individual molecules (monomers) connected by chemical forces into long chains. These chains are composed of hundreds, thousands, or tens of thousands of original simple molecules. The main element capable of forming such long chains is carbon. For example, rubber, cellulose, synthetic resins, and many other natural and synthetic polymers are formed from simple (elementary) repeating units. These units are connected by main chemical valence forces. These simple units are formed from simple chemical compounds called monomers. The word monomer comes from two Greek words: mono – one and all-part. The polymerization reaction is influenced by many factors: the structure of the polymer, the reaction temperature and duration, the type of catalyst selected (which accelerates the reaction), and the inhibitor used (which slows the reaction). In some cases, the reaction occurs rapidly with the release of a large amount of heat, thus the need arises to slow down the process. Sometimes, in order to maintain the polymer at the required molecular weight, the reaction needs to be stopped entirely at a certain point.

In such cases, a slowing agent is used. The properties of the solvent chosen for the polymerization reaction, pressure, ultraviolet light, ultrasound, and atomic radiation also affect the process. A characteristic feature of the polymerization process is that the enlargement of molecules usually occurs due to unsaturated initial monomers. No by-products such as water, hydrogen chloride, etc., are released during the reaction. Therefore, the molecular weight of the polymer is always equal to the weight of the monomer molecules. Another polymer formation process called polycondensation occurs with the release of by-products such as water, hydrogen chloride, etc. In other cases, the polymerization and polycondensation processes differ little from each other. When two or more chemically different monomers are polymerized together, copolymers with new and very valuable properties are formed. Examples of such copolymers include vinylidene chloride-chlorovinyl, styrene-butadiene, styrene-oil, and others. The full readiness of a floor coating for use begins 6–7 days after its construction, and it becomes ready after 72 hours when coated with lacquer. After the coating cures, it is possible to walk on the floor in

2–3 days. Polymer-cement mastic is used for floor coatings.

Polymer-cement concrete is intended for monolithic floor coverings. The coating can be of a single color or of the terrazzo type. The composition of polymer-cement includes cement, granite or marble filler, pigments, and a polymer dispersion of polyvinyl acetate emulsion. To prepare polymer-cement concrete coating, all components are mixed in a concrete mixer, the polymer-cement mixture is spread on the prepared base, and compacted with a vibrating screed. After hardening, if necessary, the surface is smoothed. Polymer-cement concrete floors are highly durable, impact-resistant, and erosion-resistant.The recommended coating has the following properties:

Compressive strength limit, N/cm² – 30

Impact resistance limit, N/cm² – 5

Water absorption (relative to material weight), % – 2–3

Erosion resistance, N/cm² – 0.08

The high quality of polymer-cement concrete coatings allows them to be used in machine-building enterprises and in places with heavy traffic on the floor.

Let us analyze mastic based on polymer dispersion. Such mastics are used in public and industrial buildings. The mastic is prepared from a homopolymer or copolymer dispersion of vinyl acetate and is based on modified dispersion, fillers, and pigments. Modified dispersion is a water suspension of a reactive polymer that provides water resistance, wear resistance, and hardness to the floor coatings in humid conditions. The floor coating is applied in 2, 3, or 4 layers using a sprayer,

with a total thickness of 2–4 mm.

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The physical-mechanical properties of coatings made using polymer dispersion are as follows:

Water absorption within 24 hours – up to 4%

Dry hardness on TShR-2 hardness scale – 0.05–0.15 mm

After 10 days of wetting in water – not more than 0.3 mm

Spreading (according to Grasseli)–0.004–0.02 g/cm²

This is 1.3–1.5 times lower compared to polyvinyl acetate-based floor coatings.

"Pavilit" polyvinyl acetate mastic consists of a composition of polyvinyl acetate water dispersion, mineral filler, pigment, water, and additives and is intended for constructing seamless floor coatings of public, industrial, and auxiliary buildings.

Such floors are characterized by their hygiene, attractive appearance, high erosion resistance, color fastness, and durability. The physical-mechanical indicators of floor coatings made from "Pavilit" mastic are as follows:

Thickness loss upon scratching using the VNIIC device – not more than 0.02 mm

Hardness on TShR-2 device – up to 2 mm

Flexibility on elastic scale – up to 2 mm

Impact resistance – at least 5 N/cm²

Water absorption within 24 hours – not more than 6%

Leveling compounds have putty-like consistency, while finishing compounds are suitable for pneumatic spraying. The centralized preparation of "Pavilit" mixture is organized at a pilot plant in Tashkent under the Laboratory for Testing the Quality of Materials for Concrete Mixes and Reinforced Concrete Products.

Polyvinyl acetate mastic is prepared in dedicated rooms at construction sites. The mastic consists of synthetic resins, fillers, pigments, and water. These types of floors are intended for constructing seamless floor coverings in residential, public, and industrial buildings.

The floor covering is applied in two layers (leveling and surface), with a total thickness of 2–5 mm using a nozzle. Polyvinyl acetate mastic has been used in construction across our Republic for many years. It is cheap, easy to prepare, durable in use, and easy to repair, clean, and wash. According to data from the Laboratory for Testing the Quality of Materials for Concrete Mixes and Reinforced Concrete Products, the physical-mechanical indicators of polyvinyl acetate mastic floors are presented in Table 1.1 [2].

Table 1.1

Coating layer	Water absorption over 24 hrs, %	Erosion, g/cm²	Hardness (Brinell), N/cm²	Elasticity, %
Leveling	1.8	0.007	18.3	74.5
Surface	2.01	0.063	19	54.5

Materials used for floor coatings must have superior erosion resistance, low sound transmission, good adhesion to the base, and an attractive appearance. Materials used to construct polymer-coated floors should have the above advantages. The analysis results of such materials are presented below [1].

Conclusion: The classification of floors mentioned above can be supplemented by a type of polymer-coated floor reinforced with chopped glass fibers, which has not yet been fully studied. A working hypothesis was developed to improve the construction technology of such floors. According to this hypothesis, in order to create crack-resistant polymer-coated floors, they must be reinforced with glass fibers. The base of such floors is a gypsum-aluminate cement plaster layer, which must also be reinforced with chopped glass fibers to prevent cracking.

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