UDC 725.95

M.M. Gyvljud, N.P. Stashko, I.V.Yemchenko
Lviv Polytechnic National University,
Department of building production

PROTECTIVE COATINGS BASED FILLED WITH POLIMETYLFENILSYLOKSAN TO INCREASE CORROSION RESISTANCE OF CONCRETE

The article describes the effects of surface treatment of concrete protective coatings filled of polimetylfynilsyloksan based on its corrosion resistance. The influence of the coating on the adhesive strength, hydrophobicity and water absorption of concrete. The possibility of using the developed formulations of protective coatings to improve durability of concrete is showed, which is operated under conditions of external aggressive factors.

Key words: concrete, protective coatings, adhesive strength, corrosion resistance, water absorption.

Наведено результати впливу поверхневого оброблення бетону захисними покриттями на основі наповненого поліметилфенілсилоксану на його корозійну стійкість. Встановлено вплив складу покриття на адгезійну міцність, гідрофобність та водопоглинання бетону. Показано можливість використання розроблених складів захисних покриттів для підвищення довговічності бетону, який експлуатується в умовах дії зовнішніх агресивних чинників.

Ключові слова: бетон, захисні покриття, адгезійна міцність, корозійна стійкість, водопоглинання

The statement of the problem and its relationship to important scientific and practical tasks.

Reducing the weight of buildings industrial installation and architectural expressiveness requires a significant amount of new types of structures. Reducing the thickness of the structures significantly increases their vulnerability to corrosion. The result is the destruction of the products, even after one winter, and sometimes until the commissioning of the building. Normally, the main reasons are bad quality of concrete, not properly chosen ratio of components, the use of contaminated active reactive aggregates and cement with high alkali content, high water/cement (W/C) ratio, high porosity, low water absorption and frost resistance.

Especially dangerous is a salt corrosion of concrete, that occurs as a result of crystallization of salts due to capillary leak and evaporation of saline water in the concrete conditions of operation at positive temperatures. Especially dangerous is the conversion by the action of water in crystalline anhydrous salt, accompanied by an increase in volume of the solid phase and the occurrence of significant internal stresses in the concrete background. Therefore, protection of structures against corrosion is one of the important issues in resolving issues to ensure the durability of buildings.

Increased reliability and corrosion resistance of concrete structures in aggressive environments is achieved by creating corrosion resistant building materials of new generation or new types of protective materials using domestic raw materials, criteria and methods to assess their durability.

Analysis of recent research and publications. To provide corrosion resistance and durability of concrete structures in aggressive environments is possible by using corrosion resistance raw materials and additives [1], in the case of lack of efficacy should be provided protection surface design sheet, lamina or paint coatings [2,3].

The presence of concrete crystalline and amorphous silica particles that are compatible with silicon organic matter creates prerequisites for reliable grip on the edge of contact [4].Since the surface of silicate materials under normal conditions is hydrated, when applying silicon organic compounds due to chemical interaction forms a new bond Si-O-Si, which leads to the chemical bonding of the protective coating on the surface of the concrete [5]. In this cross-linking molecules repellents is in solid silicon mesh that tightly cover all available surfaces of concrete.

The Purpose. Installing the possible use of protective coatings based on filled polimetylfonilsyloksan to improve the corrosion resistance of concrete to external aggressive factors.

The results of investigations. By method of mathematical planning of the experiment in the study of graphs "composition-property" with regard to water absorption secure concrete base set of the original coating composition, wt.%: CO-08-50 ... 60; Al_2O_3-20 ... 30; ZnO-10 ... 20 was achieved.

Laboratory studies determined the optimal fluidity of initial composition which makes up 30-34 with under VZ-4, microhardness cover-210-260 MPa and coating ability -240-270 g/m^2.

Durability and corrosion resistance of concrete in operation in wet corrosive environments depends on the rate and stability of coating adhesion strength, which depends on the degree of preparation of concrete and internal stresses in the coating.

It was established that the rate of adhesion strength after curing protective coatings in air is about 4.0 MPa when the thickness of the protective layer of 0.1 mm. Maximum adhesion strength within 6,3-7,1 MPa observed in coating thickness of 0.3-0.4 mm. By increasing the coating thickness over than 0.4 mm a smooth decrease of adhesion strength 2,3-3,2 MPa is observed, when the thickness of the protective layer is 1.0 mm, which is caused by internal disturbances in the coating and its partial destruction due to internal differences TCLE individual components. Therefore, on the basis of determining the adhesion strength to use the recommended protective coating thickness within 0.3-0.5 mm.

It is established that the integrity of the original protective coating for concrete is about 99.5%. When tested prototypes in wet conditions for 60 days the integrity of coatings reduced to 97,8-98,4%. Longer exposure to 120 days to stabilize the coating integrity at the level of 95,6-96,1%, which is sufficient to ensure the diffusion of moisture from the inner layers of concrete thermal behavior by changing the environment.

It was established that the investigated compositions of sheeting are highly hydrophobic capacity due to the presence in them polimetylfynilsyloksan component. Contact angle for covering more than 90 degrees.

Thus, the processing surface protective coatings securely closes the small pores of concrete and prevents penetration of aggressive components inside the material. Water-protected concrete decreases in 3,5-4,5 times.

Study of impact of sub-zero temperatures (-30 º C) of hydrophobic properties of protective coatings showed that the wetting angle decreases by 4-13 degrees, the rate of which did not significantly affect the protective properties. Cyclic alternating effect of temperature leads to a decrease in contact angle for wetting 10-18 degrees due to possible degradation of the components of the coating and the surface coating of concrete. Thus the obvious damage of surface coating of concrete were found, indicating that the use of protective coatings formulations designed to increase corrosion resistance and durability of concrete structures.

Corrosion resistance of concrete depends on the availability of its volume through pores and gaps through which the material can penetrate deep aggressive components of the environment and destroy the structure of cement stone.

Conducted research (Table 1 and Table 2) revealed that protective coatings increase resistance of concrete to actions of Mg^+ ions and SO_4^+. Thus the corrosion resistance of concrete increases by 20-35 and 18-21% due to the surface of the insulation from the effects of external aggressive factors.

Table 1

The corrosion resistance of fine concrete among $MgCl_2$ (term test 1 month)

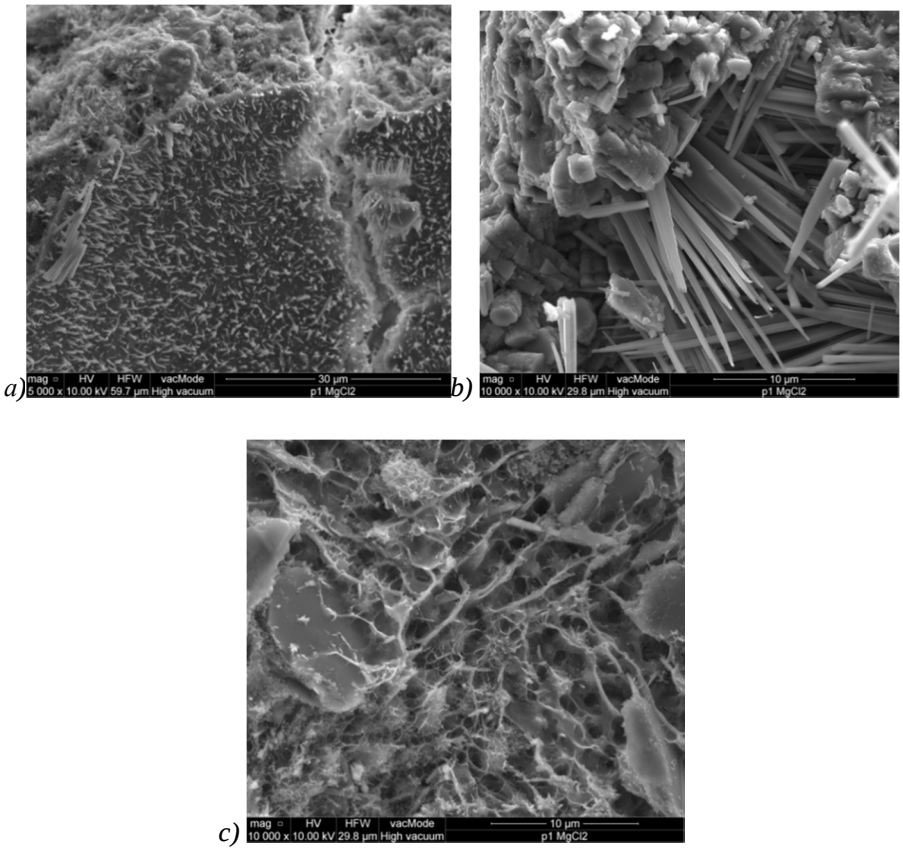
Surface of structure, №	V/C	Flexural strength compression / bending, MPa after testing		Kzg	Kst
		water	MgCl2		
No cover	0,5	40,1/4,2	28,9/3,9	0,92	0,72
3	0,5	44,7/4,3	54,1/5,4	1,25	1,21
5	0,5	43,2/4,3	47,5/5,2	1,22	1,10

Table 2

The corrosion resistance of fine concrete among Na_2SO_4 (term test 1 month)

Surface of structure, №	V/C	Flexural strength compression / bending, MPa after testing		Kzg	Kst
		water	Na_2SO_4		
No cover	0,5	40,7/4,2	37,8/4,9	1,17	0,93
3	0,5	43,2/4,3	48,4/5,4	1,26	1,12
5	0,5	44,2/4,4	47,7/5,5	1,28	1,08

Confirmation of high insulating ability of the developed formulations of protective coatings that significantly improve the corrosion resistance of concrete is its uniformity of microstructure (Fig. 1, a). Established that the microstructure of concrete represented by calcium hydroxide, etrynhit, calcium carbonate by the unreacted cement particles and pores of various sizes and configurations. After the action of corrosive media microstructure in concrete changes due to formation of pores needle and plate crystals of sulphate and magnesium chloride (Fig.1, b,c). Presence of the latter to some extent can reduce the corrosion resistance of concrete in wet conditions .



a) *b)* *c)*

Fig. 1. Microstructure cleavage finely granular concrete to (a) and after corrosive action of ions of Mg^{2+} and SO_4^{2-} (b, c)

Conclusion

1. Experimentally confirmed the possibility of increasing the corrosion resistance of concrete by treating the surface protective coatings based on oxide and silicate-filled components polimetylfynilsyloksan.

2. Maximum rate adhesion strength (6,2-7,1 MPa) coating for concrete is in its thickness 0.3-0.5 mm.

3. Contact angle sheeting greater than 90 degrees, confirming their high hydrophobicity .

4. Established that protective coatings improve the corrosion resistance of concrete steps d ions Mg^{2+} SO_4^{2-} by 20-35 and 18-21 %, respectively.

1. Babushkyn V.Y. Zashhyta stroyteljnыkh konstrukcij ot korozyy, starenyja y yznosa / Babushkyn V.Y. // Kharjkov, Vyshha shkola, 1999, - 168S.2. Sylochenko S.V. yzmenenye povrezhdennosty cementnogho kamnja v uslovyjakh mnoghokratnogho uvlazhneny y vysushyvanyja / S.V. Sylochenko, A.S. Dorofeev // Visnyk Odesjkoji akademiji bud-va ta arkh.-ry. 2005,- №20.-S.186-189.3. Shylova M.V.Kremnyjorghanycheskye ghydrofobyzatorы – эffektyvnaja zashhyta stroyteljnыkh materyalov y konsrukcyj / M.V. Shykhova // Stroyteljnye materyaly. 4. Dobrjansjkyj I.M. Vplyv kremnijorghanichnoji dobavky GhKZh-94 na vlastyvosti betonu / I.M. Dobrjansjkyj, I.I. Nikonecj // Budiveljni materialy. 2001, №4. – S.31-34.5. Pidnebesnyj A.P. Novyj ghidroizoljacijnyj material na osnovi atmosfernykh polimeriv / A.P. Pidnebesnyj, N.V. Saveljjeva ta in.. // Budivnyctvo Ukrajiny, 2008, №5. – s.30-32.

UDC 624.04

D.H. Hladyshev*, H.M. Hladyshev, A.Y. Dats****
Lviv Polytechnic National University,
*****Department of architectural design
******Department of building structures and bridges

THE METHODS FOR CONDUCTING A SURVEY OF A GROUP OF BUILDINGS OF OLD HOUSING SYSTEM FOR DETERMINING THE INTEGRATED TECHNICAL CONDITION OF THEIR ACTUAL SPATIAL DEFORMATION

The paper presents a method of an advanced integrated assessment of technical condition of brick buildings as a whole as of their deformation of the skeleton of the fixed-engineering-geological conditions of the old building. The research is carried out on the example of a group of buildings of old housing system, located in Lviv at Dzerelna Street.

Key words: survey, technical condition, deformation

Наведено методику випереджаючої інтегральної оцінки технічного стану цегляних будівель загалом за станом деформування їх остову у фіксованих інженерно-геологічних умовах старої забудови. Дослідження виконано на прикладі груп житлових будинків старої забудови, розташованих у м. Львові на вул. Джерельній.

Ключові слова: обстеження, технічний стан, деформації

The analysis of the last research and publications

The plots for new construction located in the area of long-established low-rise residential housing system, are subjected to the inspection under existing regulations [5].

If a group of existing old buildings is placed on the area that according to the scheme directly affects the location of a newly designed building, perhaps with a large hollow of underground floors, the question