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Corrosion Protection of Bridges with Polymer Compound

Protection contre la corrosion des ponts par plastiques polymères

Korrosionsschutz von Brücken durch plastische Verbundpolymere

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SUMMARY

The article presents the results of the tests carried out with practically new fire-resistant polymer-lubricating materials for bridge corrosion protection and the technology of their use on the construction site.

RESUME

L'article traite les résultats d'expériences effectuées à l'aide de matières plastiques polymères nouvelles et résistant au feu, prévues pour la protection anticorrosive des ponts, ainsi que la technologie de leur emploi sur le site de construction.

ZUSAMMENFASSUNG

Der Aufsatz behandelt Versuchsergebnisse einer praktisch neuen Klasse feuerbeständiger Polymere für den Brückenkorrosionsschutz und ihrer Anwendung auf der Baustelle.

1. THE DEFINITION OF A PROBLEM.

The durability and reliability of the bridge metallic constructions under corrosive industrial atmosphere depends considerably on the merit of installation-civil engineering works the part of which is the corrosion protection.

According to p.[1] the cost of the corrosion protection measures (materials for coatings, labour on painting, repair of coatings, maintenance) accounts for about 200 million dollars/year.

Such a cost is due above all to the fairly high cost of paint and labour on their application, and also with the confined lifetime of coatings in the corrosive industrial atmosphere (really 3 - 4 years).

In spite of the wide use of type designs and standardization of civil engineering including the corrosion protection measures the cost of bridge construction and maintenance is not supposed to be reduced in near years. The main cause of this in our view is the increase in requirements to the reliability and durability of bridge constructions being operated in the areas of high seismic activity, complex natural and climatic conditions, and also - the increase in corrosivity of industrial atmosphere.

The higher requirements to the materials for the bridge constructions,to antirust coatings in particular and consequently to work execution procedure follow from here.

At present preliminary painting on the bulky bridge constructions is as rule runs at factories of origin. However finish painting as well as coatings repair of full repainting of the object are carried out directly on site of construction, or simultanously with erection of construction, or immediately after termination of erection.

The given case obliges to carry out the corrosion protection measures in embarassed conditions or closed spaces, containing many construction joints, bolted connections or weld joints, butts, overlaps, crevices, line ends and hard approachable members of complicated shape.

Besides that in order to provide the effective corrosion protection of some consruction members it is offen impossible to

use the same paintwork material (f.e. sealing constructive crevices or connections inside of bridge box), as it requires the application of various technical procedures, painting conditions, increases terms and cost of labour.

The basic cause of difficulties related to provision of bridges effective corrosion protection lies in drawbacks peculiar to the most used paints as a kind of materials, main ones from which are:

- necessity in labour-intensive and expensive treatment of metal surface for painting.
- presence of health harmful for solvents and some other paints componens.
- fire and explosion risk of works (expecially in closed cavities).
- necessity in labour-intensive processing of multilayer application of paints.
- risk of environment pollution .
- difficulty of maintenance and repair of coatings.

It is noteworthy that use of paintwork materials in closed spaces (the bridge boxes, pontoons) is forbidden by the sanitary standards of the most countries of the world.

For the treatmrnt of listed problems VNIIK by order of the USSR Ministry for Transport Construction has developed special material of universal duty for bridges construction corrosion protection of the and as well as the operation method both in working conditions and building site.

The specifications to the material imposed by the customer are listed in the table 1.

2. THE RESULTS OF INVESTIGATIONS AND TESTS.

The polymeric-grees compound (PGC) is developed on the basis of still bottons of synthetic fatty acids with the use of modifier, polymeric additive, plasticiezer, ingibitor and surfactant.

The main characteristics of the PGC and test results are given in the table 2.

CONCLUSIONS.

The PGC has the high protective effect and replaces paintwork

materials in painting bridges:

- Simplifies application technique and reduces cost.
- Simplifies surface treatment technique for painting .
- Is nontoxic, noncombustible, includes no harmful constituents.
- Ensures safe and reliable procedure of the corrosion protection mtasures in closed spaces of any dimensions.
- Has the protective effect in the temperature range -50 +80 grad. celsium.
- Provides the opportunity for local repair of metal surface of any configuration.
- Affords to increase productivity in two-three times in comparison with the traditional of the corrosion protection techniques.
- Reduces costs of painting, maintenance and repair.
- PGC allows introduction of pigmens, biocides or decorative paints.
- Affords operations connected with use of fire.
- Afford modification of the phisico-mechanical and antirust properties in a broad range.

REFERENCES

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Table 1.

SPECIFICATION TO ANTIRUST COATINGS

1. To exclude toxity, risk of fire and explosion.
2. To increase the protective effect of coating.
3. To simplify the technique of treatment of metal surface for painting.
4. To provide the resistace of the coating to temperature variation and vibration.
5. To provide mechanization of application of coating in embarrassed conditions.
6. To provide safety of works in corrosion protection in conditions of carring out erecting-welding works.
7. To provide coating protective effect of coating in the temperature range from -50 to +70 grade celsium.
8. To ensure life-term of coatings in 12 years or more.
9. To develop the procedure of lokal repair of coating without full repair of metal.
10. To provide productivity of the technique of painting in conditions of box bridge 40 sq. m/h or more.

Table 2

THE MAIN PROPERTIES OF THE PGC

1. The appearence	Solid dark brown paste
2. Melting point, Cels. degrs.	70-100
3. Viscosity of melt, c.	20
4. Temperature of application of melt, grade cels.	80-90
5. The time of solidification at 20 Cels. degrs, min.	10-20
6. Operating temperature, grade cels.	-50 +80
7. The thickness of coating for one run, mkm	500-700
8. Approximate consumption of the material for 1 sq. m, q.	400-600
9. The procedure of application	spraying, dipping, brush

10. The treatment of metal surface for painting — mechanical cleaning
11. Other properties — nontoxic, noncombustible
12. Storage life — more two years
13. Service life — more 12 years
14. The resistance to corrosive attack (the rate of egress of iron ions from under coating), g/cm

Medium:	
1M -10M HCl	$\sim 10^{-8}$
0,1M Na_2SO_4	$\sim 10^{-8}$
1M H_2SO_4	$\sim 10^{-7}$
1M HNO_3	$\sim 10^{-7}$
1M H_3PO_4	$\sim 10^{-8}$
1M CH_3COOH	$\sim 10^{-9}$
H_2O	$\sim 10^{-9}$

15. Swellability in water, g/h — $5 \cdot 10^{-6}$
16. The technique for precise monitoring — coulometric
17. The technique of tests, USSR standard, one cycle:

temperature, C	time, h	test conditions
-50	4	freezing chamber
+50	3	air, humidity 80%
+20	17	air, humidity 80%
+40	4	hidrostat, humidity 98%
+60	4	Weatherometer, irrigation with water each 10 min.
+ 20	16	air, humidity 70-80%

18. The number of cycles — 50
19. The state of coating — No changes