

About construction of concrete anticorrosion coating in high humidity environments

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ABSTRACT

Concrete anticorrosion coating method is used as a concrete corrosion by sulfate, sewage repair measures. So far how to form the coating epoxy resin coated surface of the concrete has been used widely. However, if the coating cannot fully demonstrate anticorrosion in high humidity and prone in a closed environment the sewerage facilities in the service facilities were. Developed a method of using anticorrosion materials factory production and construction are available in high humidity environments. To protect sewer concrete long term from the sulfuric acid, should be in actual construction conditions and performance of corrosion resistance to sulfuric acid. This paper, facility construction and sulfate immersion test of cathodic protection material plant production follow-up. Invasion of Sulfur was observed in sulfate immersion test results during 2 years. Also penetration of sulfuric acid was observed concrete tracking survey,. Confirmed that this method has a concrete protection even in high humidity environments.

Keywords, Sewerage facilities, concrete anticorrosion coating, high humidity environment, performance of resistance to sulfuric acid, sulfuric acid solution immersion test.

INTRODUCTION

Chemical degradation due to sulfate to hydrogen sulfide emitted by sewage and sludge from sewage concrete structures are experiencing. Chemical degradation due to sulfuric acid, corrosion rate compared to the deterioration of concrete carbonation and chloride, alkali-aggregate reaction, quick in features. Concrete anticorrosion coating method is used as

a repair measure concrete corrosion by sulfate. Corrosion-resistant resin in concrete anticorrosion coating method and roller brush, sprayed concrete in lining coating, sheet lining to adhere to concrete corrosion protection material plant production, cathodic protection method for sulfate resistance of mortar. Construction standards these concrete anticorrosion coating method is divided by the concentration of the hydrogen sulfide gas from the sewage. Sewage water agency (ed.), "technical manual for cathodic protection and corrosion control technology of concrete sewer is operated as a guide for concrete corrosion at the Japan sewerage facilities design and construction management. Concrete anticorrosion coating construction standards and sulfide hydrogen gases, sewage works agency commonly used **Table 1**. To the show. The performance of high sulfate resistance performance of each construction standards, D type, C type, B type. Lining coating method is generally used in concrete anticorrosion coating method. Construction method this method is applied to the resin surface of the concrete, forming a corrosion protection layer. If environment a closed the facility in service repair resin that hardens in high humidity environments and concrete adhesion failure and curing failure due to corrosion prevention performance. Case study of coating lining the **photo 1**. to show.

Table 1. Upgrade of concrete anticorrosion coating method

	Coating lining Method		Sheet lining Method		Sulfate resistance of mortar	
50ppm More than	D type	-	-	D type	-	-
10ppm More than 50ppm Less than	C type	D type	-	D type	C type	-
10ppm Less than	B type	C type	-	-	B type	C type
Difficulty in maintenance, repair and home improvement	Easy	Difficult	Easy	Difficult	Easy	Difficult

Under sewage service repair solutions increases coming in the age of Japan, is expected. Concrete anticorrosion coating method and construction can be sought in such sewage service under high humidity.

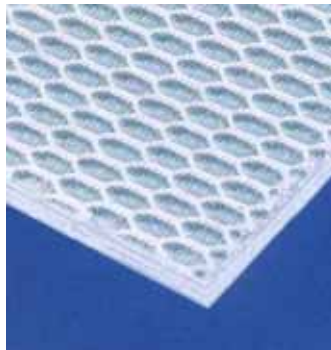


Photograph 1. Case study of coating lining

OUTLINE OF SYSTEM

Sheet lining of vinyl ester resin factory molded to anticorrosion materials and method of construction in a high humidity environment possible is a. Photos of anticorrosion materials

Photograph 2. To the show.



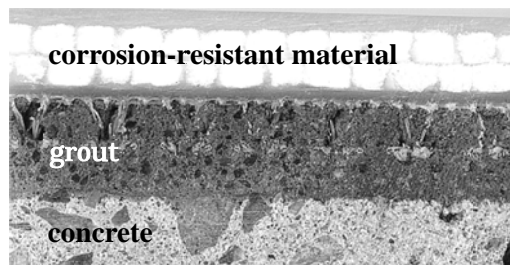
Photograph 2. Anticorrosion materials

This method is concrete surface 10mm -15mm gap to cathodic protection material, anticorrosive materials and concrete crevices filled with grout is a unifying and concrete anticorrosion coating method. Completion of construction of the **Photograph 3.** To the show.

By using Grouting materials of inorganic type not break factory molded, curing even in high humidity environments filling material to anticorrosion materials and construction in high humidity environments. Three-dimensional weaving with cathodic protection material on the back is embedded in grout, concrete and integrated. The cross-section of the construction **Photograph 3.** the show.



Photograph 3. The cross-section of the construction



Photograph 4. Construction method cross section picture

TEST OF RESISTANCE TO SULFURIC ACID

As a test to check for performance of sulfate resistance of concrete anticorrosion coating method 10% In sulfuric acid solution 28 After the days immersed in the EPMA (Electron Probe X-ray Micro Analyzer) By sulfur of method to measure the penetration is used. Concrete anticorrosion coating method used for sewer gas H_2S concentrations high and difficult inspection and repair facilities are in sheet lining. Sheet lining is exposed to severe

compared to other concrete anticorrosion coating method sulfuric and more to protect the concrete long term is required. Cathodic protection materials for use in such an environment requires the sulfate resistance performance over a long period of time. We tried to determine long term resistance to sulfuric acid and sulfate immersion test. The immersion test **Table 2.** To the show.

Table 2.

Item	Test conditions
Specimen size	Width 10 Cm in length 10 Cm
Immersion in solution	Sulfuric acid 10%
Immersion time	At room temperature
Frequent replacement of immersion in solution	1 Months in total replacement

EPMA By sulfur penetration depth measurement criteria **Table 3.** To the show.

Table 3. Sulfur penetration depth measurement conditions

Measurement conditions	
Test specimens test preparation	Vacuum deposition
Acceleration voltage	15 kV
Current exposure	100 nA
Electron beam diameter	2 μ m
Sampling time	50 ms
Data point	512 x 512
Measuring instrument	EPMA1600 Shimadzu

10% In sulfuric acid solution 2 Over the years and 7 After the year immersed in the cathodic protection materials sulphur penetration depth measurements **Table 4.** The 2 Annual immersion in sulfur concentration distribution map **Figure 1.**The 7 After the annual immersion in sulfur concentration distribution map **Figure 2.** To the show.

Table 4. Penetration depth measurements of sulfur

Period of maceration	Penetration depth of sulfur
2 years	0 μm
7 years	2 μm Following

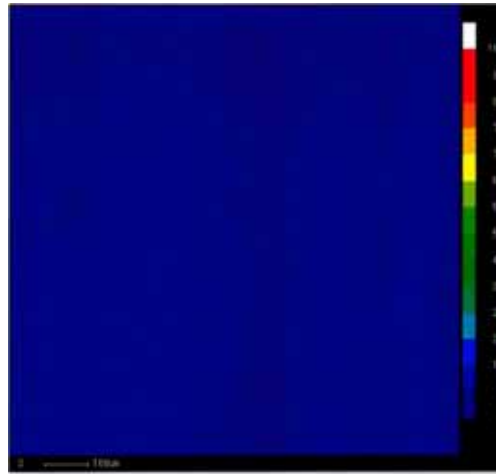


Figure 1. Sulfur intrusion concentration distributions (2 years)

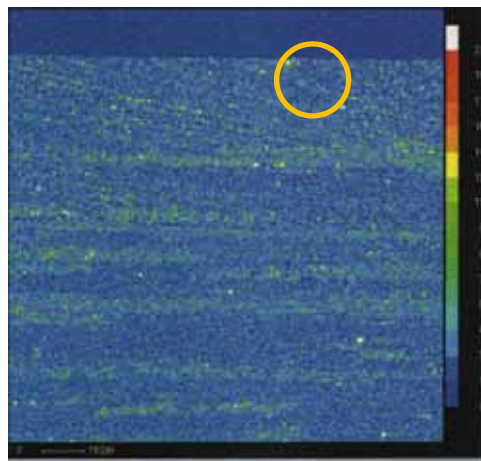


Figure 2. Sulfur intrusion concentration distributions (7 years)

7 In the year sulfuric acid dipping 2 μm Invasion of less sulfur .

FOLLOW-UP SURVEY

Went to investigate facilities in pump Hall facilities 2002 Concrete corrosion repairs carried out. To pause the operation of accommodation is a sending sewage sewage pump wells was not. Method for driving down the facilities to repair work, with vinyl ester resin construction that can be in high humidity environments was adopted. Status of completion of construction pump wells **Photograph 5**. To the show.



Photograph 5. Completion status



Photograph 6. 10 Years after State

Follow-up survey will determine status of downhole pump corrosion protection layer and corrosion-resistant surface pH Locally collected was measured, corrosion protection layer EPMA Observations. The position taken in wall mounted pump wells. "After 10 years into the pump downhole conditions **Photograph 6**. To the show.

RESULT OF FOLLOW-UP SURVEY

Downhole pumps, anticorrosive layer States **Photograph 6**. The surfaces were discolored browned in wall mounted as shown hadn't occurred, the damage in the construction end of the degradation dislodged and floating of anticorrosion materials and joints and plumbing parts etc. Status of construction joints of cathodic protection material **Photograph 7**. The status of the pipe of **Photograph 8**. To the show. Corrosion-resistant surface is **Photograph 9**. , As shown in pH1 Ranged from highly acidic conditions



Photograph 7. State of joints with anticorrosive material



Photograph 8. Plumbing Department of State



Photograph 9. Corrosion-resistant surface pH

Invasion of Iwo was observed in EDS analyses were collected in the walls of the local corrosion protection layer. EDS analysis by SEM photographs are shown in **Figure 3**. Observations of surfer that **Figure 4**. The show.

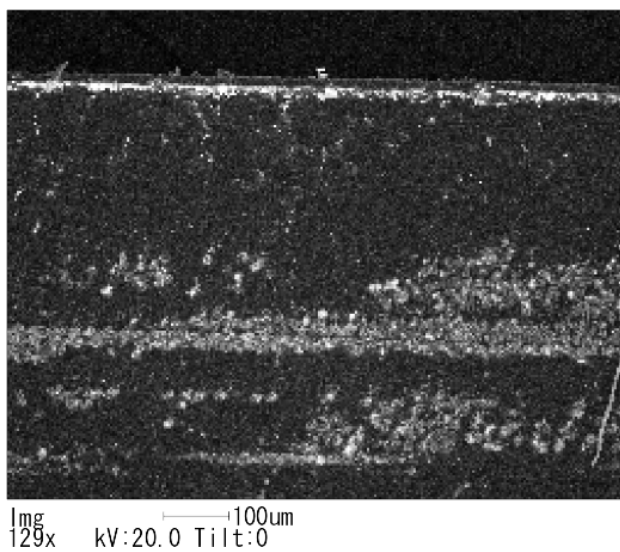


Figure 3. SEM photographs

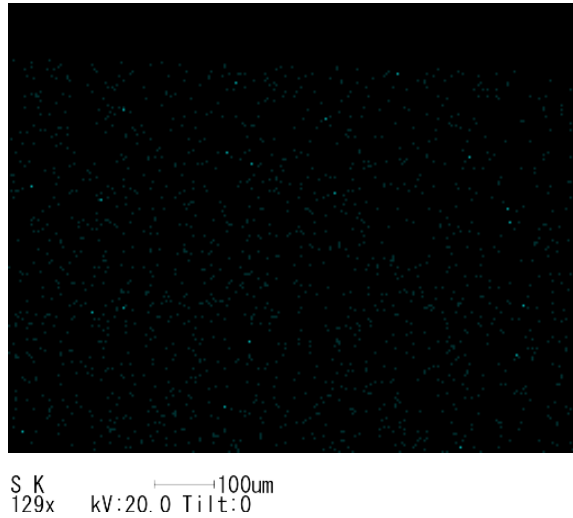


Figure 4. Observation of sulfur

CONCLUSION

2 Invasion of sulfur is significant after immersion in sulfur penetration depth measurement, 7 Years immersed in trial after measurement in 2 μ m Invasion of less sulfur were observed. Electron beam irradiating (2 μ m) resulted in undetectable from the below is the sulfur slightly broke. Is a follow-up survey of the facility are corrosion-resistant surface pH1 Of local environments are highly acidic conditions were damage or degradation of the corrosion-resistant and anticorrosive layer in construction in high humidity environment from that observed in the invasion of Iwo even for a long time, and has a concrete protection is confirmed.

REFERENCES

Japan Sewage Works Agency. (2012). *Corrosion restraint technique of the sewer concrete structure and prevention of corrosion technology manual*.