IJESRT

INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY

Anti Corrosive Rubber Coating

Atul J. Shah[*1], Prof. G.B. Bhagchandani[2]
[*1,2] L.D. College of Engineering, Ahmedabad, India
rubberpioneer@gmail.com

Abstract

The main objective of this review is to describe some of the important topics related to the use of marine and protective coatings for anti-corrosive purposes. In this context,” protective” refers to coatings for containers, off shore construction, pipe lines, pumps, steel structures, chemical equipment, bridged, storage tanks and petrochemical plants. The review aims at providing a thorough picture of state-of-the-art in anti-corrosive coatings systems. International and national legislation aiming at reducing the emission of volatile organic compounds (VOCs) have caused significant changes in the anti-corrosive coating industries. An important aspect in the development of new VOC –compliant, high performance anti-corrosive coating system is a thorough knowledge of the components in anti-corrosive coatings, their interaction, their advantages and limitations as well as detailed knowledge on the failure modes of anticorrosive coatings. The different types of anticorrosive coatings are presented, and the most widely applied generic types of binders and pigments in anticorrosive coatings.

Keywords: VOCs.

Introduction

The annual costs related to corrosion and corrosion prevention has been estimated to constitute a significant part of the gross national product in the world. Corrosion issues are clearly of great importance in modern societies. In addition to the economic costs and technological delays, corrosion can lead to structural failures that have dramatic consequences for humans and the surrounding environment. Reports on the corrosion failures of metal structure, bridges, aircrafts, automobiles, buildings, and gas pipelines are not unusual.

Both organic and inorganic coatings have been widely applied for the protection of metals against corrosion. In many areas of coatings technology the fight against corrosion has made significant progress in recent years.

Development of new “corrosion resistance” alloys permits operation of critical processing equipment in highly corrosive environment over an ever wider range of conditions. Despite significant improvements in coating technologies problems continue in the long term protection of metal from aggressive environments.

Although the oil and pipeline industry has developed reliable cathodic protection methods and monitoring systems that permit safe operation in difficult environment, these industries also experienced coating failures. One of the main reasons for the limited number of high performance anti-corrosive coating systems is the complexity of the coating substrate system and the no. of factors affecting the performance and service life of anti-corrosive coatings.

Besides the composition of the coating, this consists of binders, pigments, solvents, extenders, and additives. The performance and durability of anticorrosive coating depends on several different parameters, such as type of substance as well as several external environmental parameters. To perform its duty effectively, an anticorrosive coating must possess intrinsic durability, adhesion to the substrate, adequate flexibility and toughness to withstand impacts and cracking as well as maintain its appearance when subjected to stress, swell, mechanical abuse, or weathering.

The coating industry is a mature industry that has been undergoing a continual change in technology throughout the last few decades. International and national legislation aimed at reducing the use of volatile organic compounds has led to significant changes in the formulation of anticorrosive coatings, which traditionally have contained a relatively large amount of organic solvents. The present trend of aiming to reduce emissions of VOCs will urge the coatings industry to develop products with high-solid contents, powder coatings, or waterborne coatings with low amounts of organic solvents. Although high-solid, inorganic, waterborne and powder coatings are becoming more frequently applied, it may be difficult to substitute solvent-borne organic coatings completely in harsh environments.

An important aspect in the development of high performance of coatings systems for anticorrosive purposes in the marine and protective sector is a thorough knowledge and understanding of the interactions between the components in coatings. Furthermore, understanding of the fundamental physical and chemical mechanisms responsible for the failure of anticorrosive coatings during service may provide a basis for the designs of novel new coatings.

In contrast to previous reviews that concern single topics the overall intension of this paper is to combine the main topics related to anticorrosive coatings technology. An introduction to the different types of anticorrosive coatings presently available, the main components in anticorrosive coatings, novel anticorrosive coating ideas and a summary of most important degradation mechanisms.

Coating Additives

Paint additives and coating additives include a wide range of materials added to polymer resins, paints and coatings and other substances to modify specific processing or end-use properties. They include insulating paint additives, powder coating additives, catalysts, wetting agents, levellers, clarifier, coupling agents, deflocculates, thinners, thickeners, anti-caking agents and other chemicals. Paint Additives and Coating Additives are available in many different forms.

A wide range of paint additives, coating additives, insulating paint additives and powder coating additives made from the finest quality raw materials. These products are effective in providing water resistance, corrosion resistance, heat resistance and abrasion resistance. Our paints and coatings additives are safe and environment-friendly.

Anti-Corrosion Coating

Features

- Single pack; ready to use system (no need to mix two components)
- Quick Drying at room temperature (Dries within 15 minutes)
- Self-Priming (No need to apply primer)
- Tough & Scratch proof
- Fire Resistance – BS-163
- Excellent resistance to U.V. Radiation
- Resistance to Acids, Alkalies & saline atmosphere.
- Stable up to 2000 ^{o}C
- Available in all desired colour shades
- Available in ‘Heat Resistant’ & Heat Conductive grades.

Advantages

- Easy to apply by Brush & conventional spray techniques.
- No skill manpower requirement.
- Quick & Convenient
- Considerable reduction in painting time.
- Applicable on Ferrous & Non-ferrous metals.

Benefits

- Saves cost as compared to conventional protective paints
- Reduces the delivery period due to fast & short painting process.
- Saves Manpower & Time.

Applications

- Equipment Structural Steel
- Industrial Valves, Motors & Pumps
- Control Panels, Transformers
- Pipe Lines, Storage Tanks
- MS Structures, Chemical Plants/ Refineries/Thermal Power Complexes

Specifications for Anticorrosion Coating

Function Polymeric based protective coating to protect Metallic Structures from Corrosion in varied climatic conditions.

Features

- Self-Priming
- Single Component
- Air Drying
- Easy to Apply by Brush / Spray Techniques

Physical Properties

- Form: Liquid
- Colour :As Desired
- Odour : Characteristic Solvent
- pH : Neutral
- Density : 1.01 (+/- 0.02) at 27o C
- Viscosity : 24 sec. (B-4 Cup) at 270 ^{o}C
- Solid Content (By weight):
  - Brush Technique :45 – 50%
  - Spray Technique : 33 – 35 %

Table 1. Comparison chart

Sr. No.	Parameters	Syn. Enamels	Epoxy	Anti-Corrosive Coatings
1	Base	Alkyd resin base	Epoxy base(Thermosetting)	Specialty Rubbers
2	System	Single pack	Double pack	Single pack
3	Mixing	Thinning with the help of thinner necessary	Mixing of two components is very critical	Ready to use system
4	Necessity of primer	Red oxide primer necessary	Primer necessary	Self-priming coating
5	Drying period	4-5 hours	48-96 hours	10 min. of touch dry, 24 hrs. for hard dry
6	Possibilities of adulteration	Possible	possible	Not possible
7	Acid, Alkali and Chemical resistance	No Resistance	Good Chemical resistance	Excellent acid, alkali, chemical resistance
8	U.V. Resistance	Poor	poor	Excellent
9	Hat resistance	Poor	poor	Stable up to 200 ^{o}C
10	Life (performance)	6 months	2-3 years	10 yrs(4-5 yrs highly corrosive atm.)
11	Shades	All I.S. Shades	Limited shades	All I.S.,RAL shades
12	Salt spray resistance	Non-performance; decorative paint	96 hours	3500 hrs.

Table 2. Powder v/s anti corrosive coating

Sr no.	Parameters	Powder coating (Epoxy/Polyester)	Anti-Corrosive coatings
1	Base	Thermoplastic	Speciality rubbers
2	Form	Powder	Liquid
3	Mixing	No mixing	Ready to use
4	Necessity of primer	No primer	Self-priming coating
5	Surface preparation	Seven tank process	One tank process

6	Application method	Needs special booth, electrostatic gun and oven curing	Simple conventional equip.(auto app. possible)
7	Energy requirement	Huge consumption of electricity for oven curing	Minimum requirement of electricity
8	Drying period	4-8 hrs	10 min. at room temp.
9	Environmental safety	Disposal of sludge is an issue	Environmental friendly formulation and application
10	Acid, alkali and Chemical resistance	Moderate	Excellent
11	U.V resistance	Poor	Excellent
12	Heat resistance	120 ^{o}C max.	Stable up to 200 ^{o}C
13	Life (performance)	Not good for outdoor applications.	Excellent indoor & outdoor performance
14	Finish	One type of finish	Gloss, matt, textured finish
15	Shades	Limited	All RAL & IS
16	Salt spray resistance	300 hrs	1500 hrs
17	In case of damage	Touch up/Refinishing not possible	Touch up/over coating possible
18	Additional features	-	Resistance to fire
19	Cost savings	-	Saves electricity, time, manpower and enhances production

Application Properties

- Touch Dry 15 minutes
- Recoatable 20 minutes
- Hard Dry 24 hours
- Coverage 70 sq. ft. per litre per coat(Flat Area)
- Dry Film Thickness 35-40 microns / per coat – Spray Application
- 55-60 microns/per coat – Brush Application
- Application Method Conventional Spray/ Brush Technique
- Surface Requirement Free from dust, rust, oil, grease & any other Foreign Deposits.

Performance Properties

- Flexibility (Conical Mandrel) 4mm: No Film Crack
- Impact (60 Kg/Cm 2): No Film Crack
- Adhesion Passes Gt 0
- Scratch Resistance: 4.5 kg
- Thermal Stability 1800 oC (Continuous)
- Immersion in cold water for 7 days : No Effect Observed
- Immersion in Boiling water for 24 hours : No Effect Observed
- Immersion in Lubricating Oil for 7 days : No Effect Observed
- Immersion in Vegetable Oil for 7 Days : No Effect Observed
- Immersion in Kerosene : No Effect Observed
- Salt Spray Resistance 1500 hours : No corrosion
- Exposure to mix. Of 20% HCL & 18%
- H2So4: No Deterioration of film

Conclusion

As a technology, Anti corrosive rubber coating are alive and well. Their success as a corrosion mitigation system, due in no small part to their excellent chemical resistance and ease of use has lead to a steadily increasing global market share, which continues to grow. Anti-corrosive rubber coatings, either as a single coat, stand-alone solution or part of a multilayer coating, have consistently met the demands placed upon them in a wide variety of industrial or environmental applications. Anti-corrosive rubber coatings have a successful track record for protecting all metals, RCC, wood against corrosion all over the world—from the highly aggressive environment of the extreme conditions in the chemical, marine and water born industries. In response to the needs of these industries novel technologies have led to the development of new anti-corrosive rubber coating systems, including selfhealing and priming coatings, designed to tolerate abuse on the jobsite, as well as multilayer coatings with user friendly physical and chemical properties. The desire for increased service life through corrosion control systems has driven, and will continue to drive, further advancements in anti-corrosive rubber technology.is required day to day for different industrial corrosion problems in so many different manners.

After all anti-corrosive rubber coating is more suitable than different industrial coatings available in market in respect of labour saving, material saving, quick setting and drying time, self-priming and better storage life with minimum coating thickness.

References

[1] Koch, G.H., Brongers, M. P. H., Thomson, N.G., Virmani, Y.P., Payer, J.H., (2002) “Corrosion Cost and Preventive Strategies in the United States.” Mater. Performance, 65: 1

[2] 1. Fragata, F., Salai, R.P., Amorin, C., Almeida, E., (2006) “Compatibility and Incompatibility in Anticorrosive Painting - The Particular Case of Maintenance Painting.” Prog. Org. Coat., 56: 257

[3] Pandey, M.D., Nessim, M.A., “Reliability-Based Inspection of Post-Tensioned Concrete Slabs.” Canadian Journal Of Civil Engineering, (1996), 23 242.

[4] Picciotti, M., Picciotti, F., “Selecting Corrosion-Resistant Materials.” Chem. Eng. Prog., 102 (2006), 45

[5] Shipilov, S.A., Le May, I., “Structural Integrity of Aging Buried Pipelines Having Cathodic Protection.”, 13, (2006), 1159. doi:10.1016/j.engfailanal.2005.07.008

[6] Kouloumbi, N., Ghivalos, L.G., Pantazopoulou, P., “Determination of the Performance of Epoxy Coatings Containing Feldspar Filler.” Pigment & Resin Technology, 34, (2005), 148

[7] Dabral, M., Francis, L.F., Scriven, L.E., “Drying Process Paths of Ternary Polymer Solution Coating.” AlChE J., 48, (2002), 25

[8] Almeida, E., “Surface Treatments and Coatings for Metals. A General Overview.” Ind. Eng. Chem. Res., 40, (2001), 3. doi:10.1021/ie000209l

[9] Elsner, C.I., Cavalcanti, E., Ferraz, O., Di Sarli, A. R., “Evaluation of the Surface Treatment Effect on the Anticorrosive Performance of Paint Systems on Steel.” Prog. Org. Coat., 48, (2003), 50

[10] Santagata, D.M., Sere, P.R., Elsner, C.I., Di Sarli, A. R., “Evaluation of the Surface Treatment Effect on the Corrosion Performance of Paint Coated Carbon Steel.” Prog. Org. Coat., 33, (1998), 44

[11] Narayanan, T. N. S., “Surface Pretreatment by Phosphate Conversion Coatings - A Review.” Rev. Adv. Mater. Sci., 9, (2005), 130

[12] Nguyen, T., Hubbard, J.B., McFadden, G.B., “Mathematical Model for the Cathodic Blistering of Organic Coatings on Steel Immersed in Electrolytes.” J. Protect. Coat. Linings, 63, (1991), 43

[13] Weiss, K.D., “Paint and Coatings: A Mature Industry in Transition.” Prog. Polym. Sci., 22, (1997), 203. doi:10.1016/S0079-6700(96)00019-6

[14] Greenfield, D, Scantlebury, D, “The Protective Action of Organic Coatings on Steel: A Review.” J. Corros. Sci. Eng., 2 (2000)

[15] Walter, G.W., “A Critical Review of the Protection of Metals by Paints.” Corros. Sci., 16, (1986), 39. doi:10.1016/0010-938X(86)90121-6

[16] Chemical Publishing co. Inc., Michael and Irene Ash, New York

[17] Dupont Dow elastomers

[18] Bayer Germany

[19] Uniroyal co., United State of America