



STUDY ON MULTILAYERED POLYURETHANE AND EPOXY COATED GAS PIPE LINE FOR INDUSTRY

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ABSTRACT: Pipeline coatings have undergone dramatic technological changes over the past two Decades. Coatings now must perform at higher in-service operating temperatures, electrical resistivity protection and also must not be damaged in handling, and must provide exceptional corrosion protection. Steel pipelines are common device for transition of natural gas and raw oil all over the world. Epoxy coating in pipe line protects the pipe line from many defects. But some defects need more power to protect the pipelines.in order to avoid such defects we use another resin which is polyurethane resin which has high electrical resistivity and some similar properties of epoxy to increase the strength of the pipeline coating. Double layer coating is applied in steel pipeline by the process of plasma arc technique which applies a greater adhesion in the structure of steel. Steel pipeline is examined in testing process to check its thermal properties and strength in basis of lifeline.

adhesives, mortars and grouts in repair work. In construction, the material is the automatic and standard choice for such uses as epoxy flooring which offers wear resistance and protection as well

as non-slip, easy to clean surfaces. Epoxy resins display a unique combination of properties, making them one of the most versatile polymers with uses across a wide variety of application.



1. INTRODUCTION

1.1. Epoxy Coating and Its Applications:

Coatings are the primary means of corrosion protection for a buried pipeline whether for New construction or for pipeline rehabilitation. Epoxy resin is used in coating pipelines due to its several properties. The epoxy coating for the pipe lines is majorly for high temperature with stand as it can withstand the temperature of about more than 150 degree. Epoxy resins provide excellent adhesion to most substrates including steel and concrete making them popular with the construction industry.. Epoxy paints are used extensively as anti-corrosive primers for the pipeline in order to prevent the corrosion. Epoxy surface coating are used to line storage tanks and to make pipes and pipe linings. . Epoxy systems are used to formulate non-skid surfaces at roundabouts, road junctions and accident 'black spots'. They also protect steel reinforcement in bridges from corrosion and act as

1.2. Polyurethane Coating and Its Application:

Polyurethane is a thermosets polymer with various applications for providing the pipeline from defects. The polyurethane resin has more similar features of epoxy resins which used for coating gas pipelines.it can withstand the temperature of about 150 degree.it has high electrical resistivity than epoxy material..Due to harmless, these materials are more adjustment than anti corrosion traditional coatings with environment. this material has ability to cook in low temperature, this subject is impossible in other coatings at last, due to this coatings for application are not need to exothermicity, and they are applied in any thickness or Length and diameter of pipe.100% Solid polyurethane coatings due to suitable properties such as: high adhesion, high resistance to corrosion especially



microbial corrosion, suitable flexibility, very good friction and stroke resistance, high chemical resistance and good resistance in high temperature, have various application in external and internal coating of pipes. The other function of coating is to reduce the capacity of cathode protection installation required to achieve complete immunity from corrosion attack. Christo Ananth et al. [3] proposed a system, this fully automatic vehicle is equipped by micro controller, motor driving mechanism and battery. The power stored in the battery is used to drive the DC motor that causes the movement to AGV. The speed of rotation of DC motor i.e., velocity of AGV is controlled by the microprocessor controller. This is an era of automation where it is broadly defined as replacement of manual effort by mechanical power in all degrees of automation. The operation remains an essential part of the system although with changing demands on physical input as the degree of mechanization is increased.



2. SCOPE OF WORK

The usage of epoxy in pipe line coating in industries is mostly followed nowadays. The epoxy withstands the temperature but also at high level of heat cracks and some corrosion defects occur in the pipes. The defects are caused in both the inner and outer coating of the pipe lines. By the combination of another material which is polyurethane the defects in the pipe lines can be controlled. The life time of the resin coating of the pipe lines are not to the expected range, as by the combination of this resins it increases the life time of the pipelines used in several industries. This combination of resins increase the strength and properties of the coating material.

3. SIMILAR PROPERTIES

Both the materials have some similar properties which shows that they can increase the strength of the pipe line coating in both inner and outer layer. Some of the properties are

3.1. Temperature WithStand

The resins are made to withstand certain level of heat produced from the pipelines while the gas or oil is passing through it. Due to the high level of heat produced the pipes can get damage both in internal and external areas. To avoid such busting the resin withstand the temperature of the pipe. Epoxy and polyurethane resins have the capacity to withstand the temperature of about 150 degree and more. Due to its temperature withstand level this resin coating are also used in several areas like coating in tanks, aeroplanes etc.

3.2. Corrosion And Leakage

The steel pipes get corroded easily due to the present atmosphere. As due to the corrosion the strength of the steel pipes get weaker and damage occur in the pipes. Small cracks are produced in the pipes due to corrosion. The oil or gas get leaked due to the cracking in the pipes. In order to prevent the cracking and leakage in the pipelines the resins are coated which is thick as it provides the pipes from leakages. The epoxy and polyurethane has the properties of avoiding the corrosion in the pipelines which avoid the leakage.

3.3. Strength

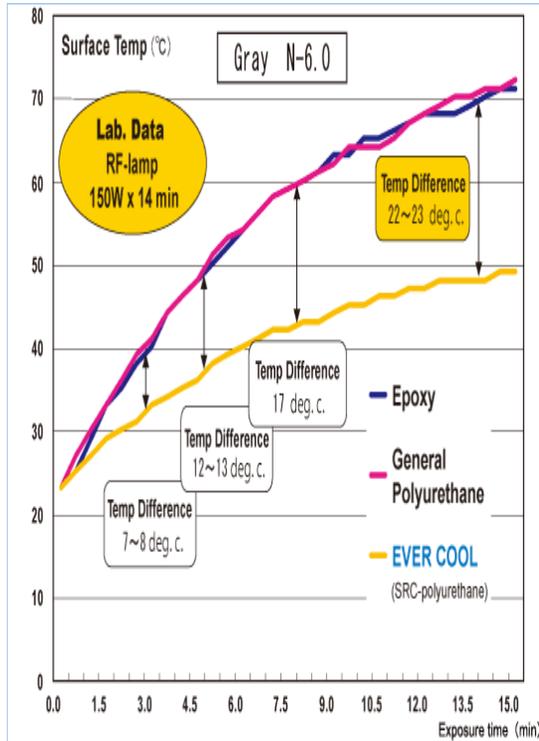
The most important property of selecting a resin for coating pipe line is strength and durability. If the strength of the material is low then the material cannot be used for coating even if the other properties of the material are higher. The strength of the material increases the life of the coating. Both the epoxy and polyurethane resins are used in the pipeline industry as because they have high strength. Some industries use epoxy for coating and some use polyurethane for coating.

3.4. Extended Service Life

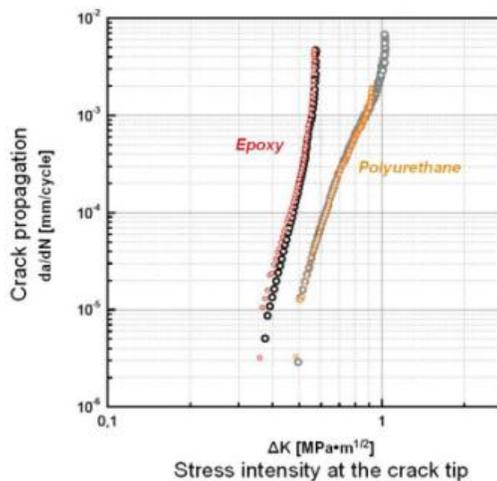
The resins increase the life time of the pipe by preventing them from damage in their structure. The polyurethane has the capacity to prevent the steel life up to 30 to 40 years and more. Same as the epoxy resins have the capacity to prevent the steel pipes for 40 and more years. So this resins are often used in heavy gas and oil pipe lines in order to increase the life of the pipes.

This are some of the properties of the epoxy and polyurethane resins used in the pipeline industries and in other areas.

Temperature Analysis Graph



Crack Analysis Graph



4. METHODOLOGY

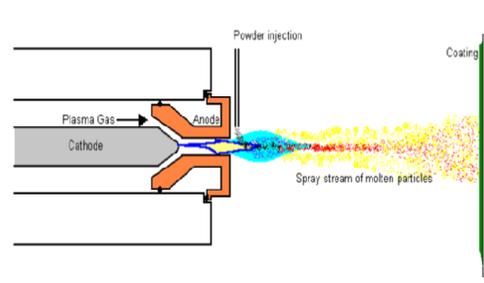
The both materials have several similar properties like they withstand the high temperature and resistance and corrosion free. The steel pipe is coated by both the resins in several industries where are not using by combining the resins.

Epoxy resin used in mixing the pipeline coating is noted and the same level of polyurethane resin is mixed in it. The combined stage of the epoxy and polyurethane resins increase the strength of the coating which increases the life time of the pipes without any type of defects. Some of the superior properties of polyurethane and some properties of epoxy gives the pipe more strength. The variable properties present in each resins get combined due to the mixing and it is coated in the pipes for giving more advantage to the pipelines.

5. EXPERIMENTAL PROCEDURE

In this process a flow of gas such as argon is directed through the nozzle of a device called plasma arc torch. When a high current electric arc is struck within the torch between a negative tungsten electrode and the positive water cooled copper nozzle, electrical and aero dynamical effects force the arc through the nozzle, which concentrates and stabilizes it. A substantial portion of the gas flows through the arc and is heated to temperature as high as 16,649 degree Celsius and accelerated to the supersonic speeds to form an ionized gas jet called plasma. A cool layer of gas next to the nozzle wall effectively insulates the torch from the tremendous heating effect of the arc column.

The epoxy and polyurethane which acts as a refractory coating material, introduced into the plasma in powder form, are melted and accelerated to the high velocity. When these molten particles strike the work piece, they impact to form dense, high purity coatings. Sprays of cold carbon dioxide gas, played on the work piece, keep it from overheating during the process and protect the purity of the coating from air oxidation. At the preliminary stage epoxy material in powder form is coated in the structure of steel and after checking its adhesion with the steel alloy then polyurethane powder form is coated over the epoxy material by the same plasma arc technique. The steel pipe line is left for few hours to get dry. Then sample is prepared to make testing for obtaining various results.





Method of plasma arc technique coating

6. CONCLUSION

The combined epoxy and polyurethane coating can be used in gas and oil pipe line industries which has higher strength than the normal coating resins. It can be used in pipeline. High electrical, strength and cohesion resistance and also resistance to crack developing such as important specification of suitable coating for external pipes of gas and oil transition pipes.

It provides performance advantage over other products including outstanding adhesion values, excellent chemical impact, abrasion resistance, flexibility, high temperature withstand etc. as there are no defects in the combination of the resins it can be handled as handling the epoxy resin.

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