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RESEARCH ARTICLE

CORROSION OF Mild steel panels, (POLISHED 0.5N WITHSULPHURIC ACID), DUE TO VAPOURS OF ACETIC ACID AND FORMIC ACID BY DIFFERENT WOODS

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ABSTRACT

The Electronic and electrical equipments made up of mild steel especially small assembly rusted in different environments and time intervals, mechanically these are fails in performance so, as to avoids these circumstances some polishing chemicals are used, but in some cases polishing is not possible in small assemblies so vapors' are used at the time of packaging in wooden boxes. An invisible layers are formed over the surfaces, after that woods emitted acid vapors because the cell wall is made up of cellulose. Failure of electronic equipments and assemblies in extremely adverse climate. e.g. having wide variation of temperature between day and night, high degree humidity (coastal areas), wide variation of temperature between day and night coupled with low humidity atmosphere is full of dust focus the attention of the worker on the deterioration of electronic equipment. These are made up of mild steel and forming the layer of ferrous sulphate, due to polishing of metal surfaces by conc. 0.5N sulphuric acid dumped in packing cases. In most of the cases due to packaging woods. It accelerate the rate of corrosion in temperate region by emitting acid vapors.

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INTRODUCTION

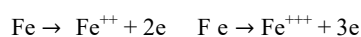
It is the process mainly electrochemical, promoted by different time durations and It is promoted by forming active sites, different aeration such as accumulation of dusty ions, sand particles, scale materials and other contaminants because it is less oxygenated area of metal, hence oxidation taking place so it increases corrosion rate. the area becomes deficient of air accessible to air containing different ions so more corrosion leading to the formation of deep cavity or localized pitting in the metal. that made different electronic assemblies It is somewhat covering of metallic part of machineries by block of wooden materials and piece of glass this portion is working as screen part of metal from oxygen access. As a consequence, changes condition may differs more exposure occurs that is why corrosion rates increases. It can be some time prevented by passivation by which a metal or alloys show high corrosion resistance due to formation of protecting layers over the surface, very thin film (about 0.0004 mm thick) Passivators tends to maintain protective film on the surface as Ti, Cr, Al and Fe containing stainless steel and mild steel alloys exhibits outstanding corrosion resistant in presence of oxygen. This is due to the formation of thin film on their surface the rate of corrosion is less when the area of cathode is small in size, then reduction area is smaller, the demands for electrons will be less and this result is the decrease rate of dissolution of metal at anodic regions. Corrosion is the deterioration of metal by chemical attack or reaction with its environmental gases and ions.

It is stable and regular problem, some time very difficult to eliminate from the electronic and electrical assemblies completely. Prevention would be more specific and resolvable than complete elimination. Corrosion processes develops faster rate after disruption of the protective film over the surface Barrier and are accompanied by a number of reactions that change the composition and properties of both the metal surface and the local environmental condition, for example, formation of oxides, diffusion of metal cations into the coating matrix as oxidation process, local pH changes, and electrochemical potential at specific points The study of corrosion of mild steel and iron is a matter of tremendous theoretical and practical concern and as such has received a considerable amount of interest. 0.5N Acid solutions, widely used in industrial acid cleaning, acid rescaling, acid pickling, and oil well acidizing, require the use of corrosion inhibitors in order to checked their corrosion attack on metallic materials in specific points. Over the years, considerable efforts have been deployed to find suitable corrosion inhibitors of organic origin in various corrosive media (1-3) The concept of total corrosion control should be introduced in which corrosion control is more in a daily activities at all stages of production than merely an after thought. Good corrosion control. An inhibitors are a organic compounds that, When added in the surface in small amount to an environment, effectively decreases corrosion rate To prevent corrosion rate there are several classes of inhibitors specially designated passivators 1, organic inhibitors 2, including slashing compounds and pickling inhibitors, and vapor phase inhibitors 3.

The practical work of corrosion inhibitors are greatly influenced by new methods that have been developed because of toxicity in environment effect, resulting from industrial effluents. The strength of chemical reduction on initial contact of passivators which makes the active sites passive with metal, according to this point of view, must be at least chemically equivalent to the amount of passive film formed as result of such reduction. From the passive film on mild steel this is in the order of 0.01 cm² of apparent surface. The total equivalent of chemically reduced chromate is found to be of this order and it is probably also same for the other passivators acting on iron. The amount of chromate reduced in the passivation process is arrived at from measurements (4-6). In the type of vapour phase process various type of material are widely used such as polyaniline (7-9), Polypyrrole (10) and poly acetylene (11). Heavy effort have been deployed to find suitable corrosion inhibitor for organic origin in various corrosive media (12-16). In acid media, nitrogen based materials and their derivatives, sulphur containing compounds, aldehyde, thioaldehydes, acetylenic compounds and various alkaloids. The acetic acid which is 98% pure can increase the rate of corrosion within 24 hours if the humidity is 80% to 100% RH. (17)

MECHANISMS OF CORROSION

Corrosion is the deterioration of a material as a result of reaction with its environment, especially with oxygen. Although the term is usually applied to metals, all materials, including ceramics, plastics, rubber, and wood, deteriorates at the surface to some extent when they are exposed to certain combinations of liquids and /or gases. Common examples of metal corrosion are the rusting of iron, the tarnishing of silver, the dissolution of metals in acid solutions and the growth of patina on copper. Most research into the causes and prevention of corrosion involves metals, since the corrosion of metals occurs much faster under atmospheric conditions than does the corrosion of nonmetals. The cost of replacing equipment destroyed by corrosion in the United States alone is in the billion-dollar range annually. Corrosion is usually an electrochemical process in which the corroding metal behaves like a small electrochemical cell. Since the corrosion of iron by dissolved oxygen is, from an economic standpoint, the most important redox reaction occurring in the atmosphere, it will be used here to illustrate the electrochemical nature of the process. A sheet of iron exposed to a water solution containing dissolved oxygen is the site of oxidation and reduction half-reactions, which occur at different locations on the surface. At anodic areas, iron is oxidized according to the Reaction Anodic Areas



At the same time, oxygen molecules in the solution are reduced at the cathodic areas.



The two processes produce an insoluble iron hydroxide in the first step of the corrosion process: Generally, this iron hydroxide is further oxidized in a second step to produce Fe(OH)₃, the flaky, reddish brown substance that is known as black rust. Unfortunately, this new compound is permeable to oxygen and water, so it does not form a protective coating on the iron surface and the corrosion process continues. All metals exhibit a tendency to be oxidized, some more easily than others. A tabulation of the relative strength of this tendency is called the electromotive series of metals. Knowledge of a metal's location in the series is an important piece of information to have in making decisions about its potential usefulness for structural and other application

MATERIAL AND METHODS

Mild steel panels of the size 12.5 cm × 5.00 cm, 10.50 cm × 5.00 cm, 7.5 cm × 5.00 cm (cut from single sheet) of pickled cold rolled closed annealed (6SWG) were used in all experiments. The composition of the mild steel sheet was iron 99.74%, carbon

0.07%, silicon 0.07%, sulphur 0.044%, phosphorus 0.049%, manganese 0.023%. All panels were carefully polished with successive grades of emery paper for removing all surface defects. The final surface was brought to standard finish by polishing with 000 grade emery paper. All cuts, edges, corners and suspension holes were rounded off and smoothed. After surface preparation panels were degreased with sulphur free toluene. This was followed by treatment with methyl alcohol to remove sweat residue and finger prints. polished with conc. sulphuric acid 2N solution. The specimens were dried and then transferred to a vacuum desiccators in which they were allowed to remain for a period of 24 hours and 48 hours.

CORROSION EXPERIMENTS: After surface preparation panels were weighed (weighing was done with the help of single pan weighing machine). For the identification of panels all the panels were numbered and suspension holes were made. Weighed metal panels, were exposed to synthetic atmosphere of different humidity or corrosive vapours. The samples were withdrawn after a specified time and the extent of corrosion was determined by weight gain or weight loss method. The de rusting was done by using appropriate de rusting solutions. The de rusting solution used was conc. HCl containing 5% stannous chloride and 2% Antimony trioxide at room temperature. After removal of corrosion product, the metal panels were washed with distilled water followed by immersion in absolute alcohol or acetone, drying with hot air, cooling in desiccators and weighing. The weight losses of specimens due to corrosion were determined by subtracting the weights of de rusted panels from their original weights. The specimens were suspended in sealed desiccators (one liter capacity) by glass hooks with the help of glass rod fixed tightly on the inner walls of the desiccators. Care was taken to put grease on the lid properly so that once closed, the system was fully sealed. In order to make sure that the un corroded metal was not removed from the panels by the de rusting solutions, blank was run in each case to check the amount of metal removed in the process of de rusting. It was found that metal removed from the blank did not exceed 0.1% of the total corrosion value. It has been reported by Evans if the rust consists of Fe(OH)₂ and no other compounds, the loss in weight should be 1.69 of that of the gain in weight. Since in our study, other compounds were likely to be formed the weight increments might not give the true picture, as in many cases where the corrosion product were not of adherent type or where leaching of the corrosion product could have been possible, the weight increments were not suitable as a method for assessment of the corrosion rate. The corrosion has been measure in mg/dm² of the surface area.

PREPARATION OF SYNTHETIC HUMID ATMOSPHERE:

The humid atmosphere of known RH was produced by using sulphuric acid of appropriate density, AR quality sulphuric acid was used for the purpose and the required dilution was done by distilled water. The concentration of acid for different RH was as follows:

For 20%RH. H₂SO₄ 31.39 % by volume For 40%RH H₂SO₄ 25.90 % by

For 60%RH. H₂SO₄ 20.80 % by volume For 80%RH. H₂SO₄ 14.55 % by volume

For 100%RH. H₂SO₄ 0.0 % by volume (Distilled water)

RESULT AND DISCUSSION

From the fig no 1 and fig no.2 it is clear that corrosion taking place due to open atmosphere at the temperature is room temperature figure no 1 shows the starting of corrosion at 24 hours of experimental set up. Figure no.2 shows the starting of corrosion after 48 hours Table 1 depicted that corrosion of mild steel at different relative humidities (100%RH to 20%RH) for different time duration. Result shows that corrosion of mild steel increased with exposure time (24 hours to 96 hours). The corrosion rate is maximum at 80% RH during entire exposure time. It was minimum at 20%RH.

Table 1. Corrosion of mild steel for different time durations at different RH. polished with sulphuric acid.

S. No.	time in hours	100% RH wt loss (mg/dm ²)	80%RH wt loss (mg/dm ²)	60%RH wt Loss (mg/dm ²)	40%RH wt Loss (mg/dm ²)	40%RH wt Loss (mg/dm ²)
1.	24	14.00	18.00	11.00	7.00	4.00
2.	48	22.00	27.00	13.00	8.00	7.00
3.	72	30.00	38.00	28.00	14.00	10.00
4.	96	38.00	47.00	37.00	19.00	12.00

Table 2. Protective effect of metadinitrobenzene on corrosion due to vapours emitted by mango wood

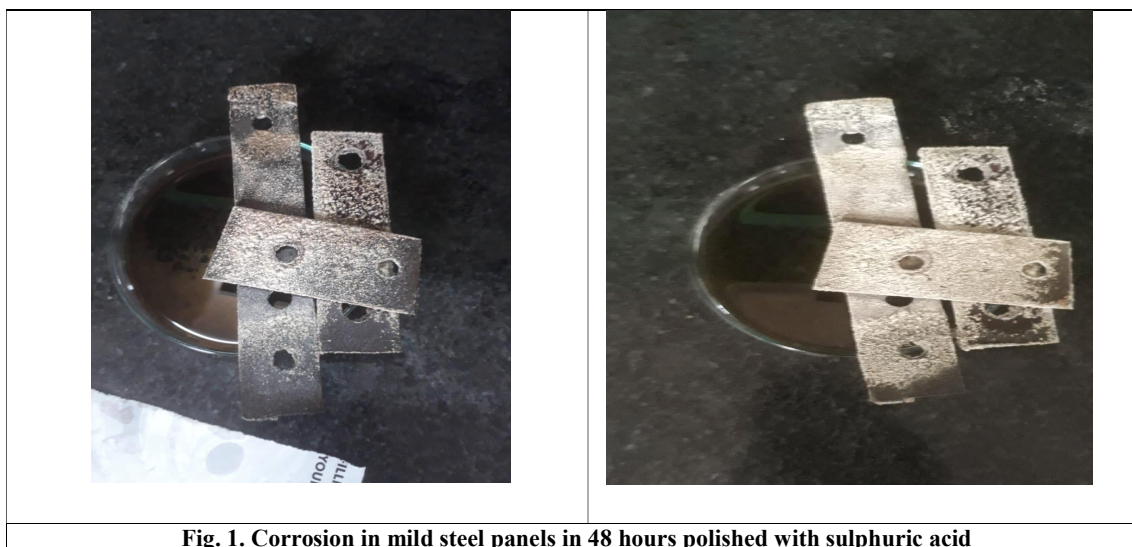
s.no	time in hours	80%RH		100% RH	
		Wt loss (mg/dm ²)	Protection %	Wt loss (mg/dm ²)	Protection %
1.	24	2.40	94	0.0	100
2.	48	2.60	96	8.8	72
3.	72	7.3	93	12.2	74

Table 3. Protective effect of metadinitrobenzene on corrosion due to vapors emitted by Jamun woods

s.no	time in hours	80%RH		100% RH	
		Wt loss (mg/dm ²)	Protection %	Wt loss (mg/dm ²)	Protection %
1.	24	9.10	92	9.20	92
2.	48	14.40	80	14.00	80
3.	72	17.40	83	16.00	83

Table 4. Protective effect of metadinitrobenzene on corrosion due to vapors emitted by Eucalyptus woods

s. no	time in hours	80%RH		100% RH	
		Wt loss (mg/dm ²)	Protection %	Wt loss (mg/dm ²)	Protection %
1.	24	7.00	93	9.20	92
2.	48	12.00	89	14.00	80
3.	72	17.40	83	16.00	83

**Fig. 1. Corrosion in mild steel panels in 48 hours polished with sulphuric acid**

The corrosion rate was slight less than that at 80% RH. The corrosion rate at 60%RH was less than that at 100%RH and corrosion rate at 40% RH was less than that at 60% RH due all these data corrosion was maximum in between 75% RH to 90% RH Table 2 depicted protective effect of metadinitrobenzene on corrosion of mild steel due to vapours emitted by mango woods at 80% RH and 100%RH during a period of 24 to 72 hours. Results shows that at 80% RH met adinitrobenzene is highly effective. It afforded 93% to 96% protection up to four months. It afforded 84% protection during 72 hours. At 100%RH complete protection was obtained during 24 hours there after the percentage protection decreased. Its value being 72% during 24 to 72. Table 3 depicted protective effect of metadinitrobenzene on corrosion of mild steel due to vapors emitted by Jamun woods at 80% RH and 100% RH during the periods of 24 hours to 72 hours. Results shows that percentage protection gradually increased with time At 80%RH met adinitrobenzene afforded good protection during 24 hours to 72 hours.

In case of Jamun woods metadinitrobenzene was not very good inhibitor at 100% RH. In this condition It afforded approximately 83% protection. It protected 92% during 24 hours to 72 hours from this result it is clear that metadinitrobenzene is very good effect on vapours of Jamun woods Table 4 depicted that protective effect metadinitrobenzene corrosion of mild steel due to vapours of Eucalyptus woods at 80%RH to 100% RH, during a period of 24 hours to 72 hours. Results shows that at 80%RH metadinitrobenzene is highly effective it afforded complete protection during shorter duration in 24 hours one approx.90% protection during longer duration of 72 hours. The inhibitor was not so efficient at 100% RH, It afforded 50% to 60% protection at different time durations. The weight loss was obtained was approximately double at 100%RH than that obtained at 80%RH during exposure time from 24 hours to 72 hours.

CONCLUSION

From the above data it shows that mostly wood are vapours producing materials which contains cellulose on hydrolysis it produced the vapour of formic acid and acetic acids the vapours are corrosion accelerating materials. On packaging most of the wood materials are used which is compactable with transportation. Most of the electronic assemblies are transported and packed by wood which produced acidic vapours. mainly mango woods, Jamun woods, Mahua woods, Eucalyptus woods, kathal woods. If the vapors of protective materials are used so corrosion product will be least and materials can be protected.

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