Laboratory Studying of Effect Factors to Gas shaft by Petansio Dynamic Test

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Abstract: Corrosion engineering of country pay attention to high cost of corrosions and Reducing of this cost is necessary for country's oil, gas and petroleum Industry. 10% of produce cost of one Barrel of Crude oil is for corrosion cost of related industries. Particular continental conditions, History of country refiner and produces crude oil kind are main factors to influence corrosion cost in countries oil industries. There is a large mar of technical literature about test of electro chemical for kinds of metals and corrosives environment. Majority of this literature is written by experienced electrochemist and corrosion engineer's and with use of scientist and engineers begins with test of chemical electro corrosion. Most destruction in gas shaft is because of local corrosion. Local destruction that cans occur blew insulators, sediments or with bacteria is 10 or 100 times quicker of monotony corrosion can destruct it. Ikada Believed that incomplete grow of iron carbonate crystals (FeCO$_3$) lead to small region of Anod and ringworm corrosion. Pirit product (FeS$_2$) in metal surface in above $100^{\circ}C$ is constant according to thermodynamic and in lower temperature speed of layer formation become slowly and Increase the corrosion. Corrosion often in sour shaft occurs in lower density of 2000 ppm of this gas and between 5 to 6.5 plt. In this paper we examine laborites factors by dynamic petansio test that has affect on corrosion in gas shaft.
[Soroush Zarinabadi, Mehrdad Sotoudeh, Amir Samim. **Laboratory Studying of Effect Factors to Gas shaft by Petansio Dynamic Test.** *J Am Sci* 2012;8(9):206-211]. (ISSN: 1545-1003). http://www.jofamericanscience.org. 31

Keywords: Corrosion, Crude oil, Gas shaft, chemical electro corrosion, dynamic potential.

1. Introduction

Corrosion engineers of country pay attention to high cost of corrosion and cost reduction is necessary in oil, gas and petroleum Industry. 10% of produce cost one barrd of crude oil is for corrosion cost or related industries. Cost rate of corrosion in the word for one barrel of crude oil is 42 to 80 cent. Particular continental situation, History of country refinery and kind of produce crude oil are factors that influence corrosion in country oil industry.

2. Corrosion mechanism

Gases such as carbon dioxide, Acetic Acid, and other Aliphatic Acids with short chains lead to low or high of production. Existence of this gasses and Acids can complicate problems of corrosion control in shafts. Corrosion in Gas and oil shafts has electrochemical mechanism and when it reaches below the dew point, existing wet become liquid, there are more drops on walls tube.

Water has electrolit role in electrochemical reaction. Produce water is not corrosive. When acidic gases such as CO$_2$ and H$_2$S are dissolved in water produce Acidic environment that near still produce strong corrosion. Sometimes in shaft oil oxygen account as corrosive gasses but in gas shafted there isn't oxygen problem. Source of H$_2$S gas can be sediments in earth layers, process reactions by-products of gas and oil formation or bacterial activities. Most destruction in shaft gas is occurring due to local corrosion that can occur below the insulators, sediments and by bacteria activity and is 10 or 100 times rapid than monotones corrosion can occur destruction.

Another kind of local corrosion is due defects or file. Appearance form of destruction in this situation is different.

Defect of FILC in the present of CO$_2$ seen as aperture of needle form. We can divide corrosion due CO$_2$ in gas shaft to 3 temperature region:

A. Below $140^{\circ}F$ ($60^{\circ}C$) corrosive product can't protect surface and form strong corrosion.

B. Above $300^{\circ}F$ ($150^{\circ}C$) form magnetite and environment untied with insignificant value of salt water has less corrosive.

C. Layer of Iron carbonate product has protective role and even doesn't need to prohibition, but in the present of destructive ion such as color ion or hydrogen solfid and high speed of Flour, can destruct this lager. In the situation of flour turbulence and speeds above 10 m/s layer protective is Impermanent.

Ikada believed that incomplete grow of Iron carbonate crystals (FeCo$_3$) has create small Anod environment and ringworm. Pirit product (FeS$_2$) at temperature above $100^{\circ}C$ on the metal level is permanent in the dimension of thermodynamic.

Formation of this layer in lower temperature is less and increase corrosive. In Acidic shafts corrosion occur in density below 2000 ppm this gas and in range of 5 to 6.5 plt.

3. Factors that influence to gas shaftes corrosive
3.1. Temperature
Temperature effect of flour corrosive in ages and oil industries is similar to others chemical environment. In the most of corrosive reactions temperature cause to increase speed of corrosive and for every $20°F$ ($11°C$) in temperature increase, corrosive speed became twice.

In steel corrosion in the proximity of corrosive gas of CO_2, there are 3 kinds of temperature regimes.
   A.   In temperature below $60°C$, Iron carbonate is soft and non preservative and corrosive rate is function of insignificant pressure of CO_2.
   B.   Corrosion in the temperature between $60°C$, $150°C$ form one protect layer of Iron carbonate and corrosion rate reach to acceptable level.
   C.   In the temperature above $150°C$ form one layer of mange tit that is protecting entirely and resister to high speeds and strong turbulence and is sensitive to colored ion.

Although in this 3 kind we don't consider effect of saltwater, liquid speed and rate of insignificant pressure of H_2S gas to CO_2 gas to corrosion rate.

This factors should be considered in determining the protect of layer.

3.2. Pressure
High pressure of gas shafts affect to corrosive gas solvency in liquid gas pressure can reach to 12000 psi.

Insignificant pressure of each corrosive gas is very important. Corrosive values of one shaft according to CO_2 gas value are as below:
   -   Insignificant pressure of CO_2 less than 7 psi of non corrosive environment.
   -   Insignificant pressure of CO_2 between 7-3 psi of corrosive environment.
   -   Insignificant pressure of CO_2 above 30 psi of corrosive strong environment.
   -
3.3. Role of floured in corrosive
Experience show that in shaft we can see corrosive problem that value of water cut in flour is above 85%. But there are exception cases.

Emulsion amount in shaft flour affect to flour performance and conductivity as a conductor. Shaft that produce water (without emulsion) have higher level of corrosive relatives to shaft with less water cutting and more emulsion. For determining flow

corrosive we do a lot investigation. Bradbern studied 20 different shaft and account value of water and Acidic gas CO_2 as a variable. He found that if value of water produce is more, value of solvent CO_2 gas is also more and produce more corrosive.

3.4. Flour speed
Flour speed has basic role in determining regime of flour and regime of and flour regim determining kind of corrosive and performance of each inhibitor.

Experiments show that if flour regime is same in the field and experiment condition, mechanism and corrosive rate are same in each 2 situation.

For studding effect of speed in corrosive we should consider 3 range of temperature for corrosive that is due to CO_2 in low temperature (blow $20°C$) it depend to CO_2 Hydrolyze speed in corrosive range and is independence of speed. Speed in range between 20 to $60°C$ have insignificant role in corrosive because it can slow CO_2 pertain reaction. But in above temperature condition (above $150°C$) form magnetite layer.

Corrosion speed can Increase of 15 m/s without it damage to corrosive product, until there are factors such as color Ion. So if the temperature of shaft above is above $150°C$ and there isn't color Ion, we can't have any corrosive wmtil flour speed is more 15 m/s, but if temperature is below $150°C$ but if temperature is below $150°C$, corrosive is in the shaft nozzle but if we have more water produce in shaft, in the whole of shaft we have corrosive.

3.5. Flour composition
Composition of saltwater according to solvent solid particle affect to formation of protective layer. Color in water is not corrosive and only has role in destruction of protective layer. Gas liquidity is obstacle for corrosive and even some of liquidity has contained natural liquidity but is not obstacle for local corrosive.

3.6. Metallurgy
Morphology and kind of Aliage in system affect to value and corrosive kind. In steel J-55 prelist can produce corrosive but in martini steel such as N-80 and C-75 we see less local corrosive.

Worming corrosive is thermal operation steel. Steels in proximity of hydrogen solfid tend to crack. This cracking dependent to Algae laments, phase construct and their solidity.

One proper guide for selection of steel in sour system is predicted in IF166 NACE standard. Steels in proximity of H_2S have SCC or tension corrosives that produce hydrogen on the common chapter of

electrolit-metal is main factor for this fracture. Martini is main factor in attach of hydrogen solfid and thermal operation compatible steel site corrosive condition.

3.7. Corrosive gases

H_2S and CO_2 gases are corrosive factors in oil and gas shafts but each of these gases in proper situation can protect. For example in the temperature above $100^\circ C$ hydrogen solfid gas can produce resister Pirit (FeS_2) that entirely protect.

When this gases are compound has complicated effects on corrosive. Mr. Danlop believed that if in this situation proportion of CO_2 to H_2S id less than 500, it forms solfidilayer. Hasbro Estegman believed that in above temperature situation, and when insignificant pressure of CO_2 gas proportion to insignificant pressure of H_2S is more than 2000, this figures become large. Hydrogen solfid can not destruct Iron carbonate layer.

3.8. Ways of corrosive control

For control of corrosive, protect of piped and walls of gas shafts we can use of following methods.

A- Place elastic resistant covering inside the pipe.
B- Use of resistant Alleyes to corrosive.
C- Use of nonmetal material.
D- Use of stabilization of PH.
E- Injection material of corrosive inhibitor.

4. Corrosive experiments

Form and size of experimental example is variable according to laboratory tuber colossi. Often it's proper that proportion of surface area to mass and often we use round or square example with less thick.

But all examples should cut from metal sheet center to avoid edge effect, if we want to have same result, we should select layer with clear thickness from metal surface to removal defects and surface edge less differences in chemical compound and structure and application due to Rolling-pin.

We should at least select between 10 to 20 micron from metal surface and we should apply these methods: cleaning in Acid, surface friction with proper paper. In this survey after we prepare example with 1mc of common steel AXL51X52 with chemical Analysis to removal Rolling-pin defects we should select coarse paper with $40^\circ C$ and with grain paper with $200^\circ C, 400^\circ C$ and $800^\circ C$.

4.1. Test situation

Water solution that used in laboratory, is real example of flour produce in Iran field gas and we select water example of shaft that is not apply injection of material of corrosive inhibitor on it that has studding carefully of produce flour corrosive rate and decrease of corrosive, also we should studding PH of solution and we should solutions to prohibit changes in PH, it is proper that we would not down in the solution until it is necessary.

If it is necessary to dawn air we should not allow oxygen to collusion to surface, because there survival reaction can become oxygen and produce corrosion. For not having solution of air we can use of this test for doing it we can use of nitrogen gas in half-hour before experiment, mass of solution should enough large that can obstacle for reduce of corrosive material and prohibit of collection of corrosive productions. In this experiment solution mass with respect to laboratory tuber colossi wit 500 mm.

Temperature should control with $\pm 1^\circ C$ and assume temperature room with $25^\circ C$ temperature should stabilize in experiment container to aroid thermal slope that can change solvency capability and potential change. In order to studding effect of flour speed on natal example corrosive we should use one pump and with respect to that exit establishment place of tuberculosis is very small and can stabilize solution example surface, we should embedded one trend of pass from pump exit to pump entry save repository and one trend from pump exactness to entry. Above case is for avoided of heating pump in low capacity.

Both trends is accompanying with current control. We see necessary equipments for turning flour in film.

4.2. Electrochemical experiments

There are several ways of electrochemical for studding corrosive, but it is clear that studding with details is problematic. We here studied stat potential dynamic potential, stat galvano.

4.3. Interpretation of electrochemical experiments

For perform experiments and meet necessary points, we should do several electrochemical test in different operational situation on electrode example in gas field water electrolit. At first we describe several situation of test and the we can reach to interpretation and conclusion with perform electrochemical test and compare with each other.

Situation 1- performs tests in Blank situation.

Situation 2- performs tests by adding 50 ppm of prohibitory material, corrosive to solution.

Situation 3- performs tests by adding 100 ppm of prohibitory material, corrosive to solution. Situation

4- Performs tests by adding 50 ppm of prohibitory material of corrosive and at the same time with flour turning situation.

5. Potential Dynamic test

We can use of DC based on polarization studding corrosive speed on metal piece. When not perform particular reaction in balance state, change of free energy that lead to exchange of current density is activity energy that before metal atom leave network metal and enter to solution as a Ion or is metal Ion and seat as sediment of metal surface should overcome to it.

Primary small difference between solvency and metal sediment perform electricity dual layer or common area between electrode and solution. For perform one of process such as solvency, potential decline along dual layer is increase. This potential increase called addition voltage n of an activity, that this voltage is necessary energy with considerable speed for performing reaction. And this additional voltage should apply to that reaction before discharge. Additional potential for polarization stated with Towel Equation. So reaction speed change with apply additional potential change.

In addition if Electrode potential is positive to Roorsibl potential occur oxidation absolute and if electrode potential is negative to Roorsibl potential occur katod ratio or survival operation. In the above section we assume that solvent metal Ion directly enter to solution in activity polarization and there are enough metal ions in katod reaction for sediment. This assumption is not correct because Ions pass of dual layer need to certain time and will have slope in solvency and metal sediment of metal Ions density along dual darer.

Because metal Ions density in common chapter (in dual layer) is different with metal Ions density of 2 solution and nearest equation show that wale of electrode potential is different with Roorsibl state potential this difference in potential is recognized as density polarization. Density polarization is only important for survival reactions (semimetal) and is less important in metals electrical sediments. Because in electrode are there is very metal Ion and it's density in solution is less as a result penetration speed along dual layer is high and this polarization doesn't slow reaction speed.

But because Ions is moving in the solution contain current; there is another source for produce additional potential. If solution was fine conductive of electric and Ions move along straight line we can ignore solution resistant. This solution was not fine conductive as a result solution have resistances solution and also for omit resistance polarization or IR decline, distance of electrode reference and work electrode should be near each other and we ignore of resistance polarization (or IR decline in solution) in solution that are fine conductive. Just as we can see of tafel chart from performing potantio dynamic this

polarization was activity kind and density and state that with increase inhibitor density, decrease corrosive speed and is indicative of Isotrom attract by surface and with respect to Tafel slope, corrosive current icorr, Ecorr polarization resistance and corrosive rate is determined as a table.
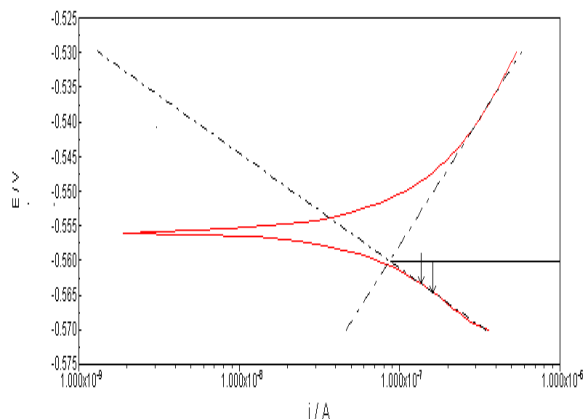

Figure 1. potentiodynamic in Blank state-without any anticorrosive material and flour in constant state.
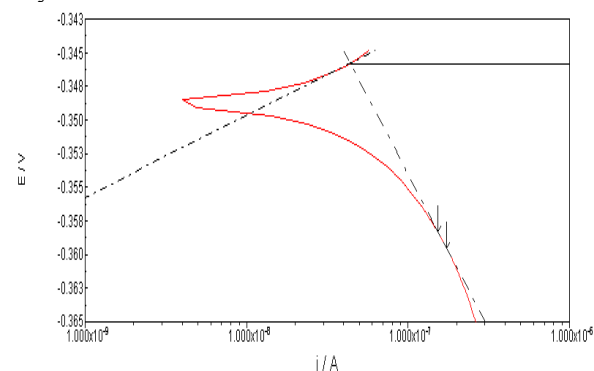

Figure 2. Example potentiodynamic in state of adding corrosive inhibitor material in 50ppm to Resident flour.
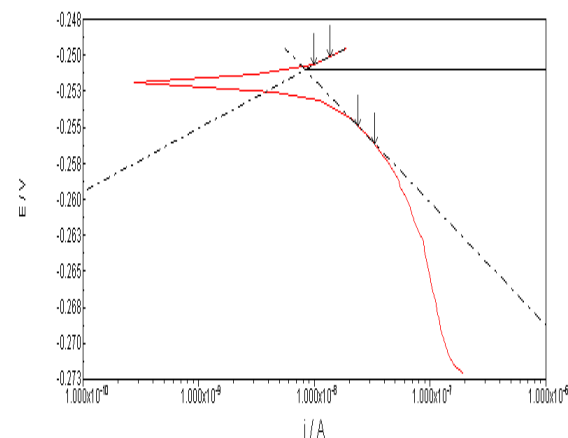

Figure 3. Example potentiodynamic in state of adding corrosive inhibitor material in 100ppm to Resident flour.

6. Polarization resistant

Speed effect to corrosive phenomenon studding by several test when use of Inhibitor and we can't repeat taste and in each test corrosive rate is different and as a result of changing Resident state to turbulence, density polarization is decrease and increase corrosive and on the other hand Increase of electrolit speed can have beneficial effect, Because this leads to reach inhibitor to metal surface and inhibitor can act effectiveness.

Table 1. Result of potentiodynamic in Blank state – without anti corrosive material and flour in Resistant state.

I corrosion	8.666 E-8 A
I corrosion	8.666 E-8 A/cm^2
Bc	.037v/dec
Rp	.017v/dec
E corr,obs	-.556 v
E corr,calc	-.56 v
E-begin	-.563 v
E-end	-.541 v
Corrosion rate	2.036 E-3 mm/year

Table 2. Result of potentiodynamic test in adding corrosive inhibitor material in 50ppm level to Resistant flour.

I corrosion	4.378 E-8 A
I corrosion	4.378 E-8 A/cm^2
Bc	.006v/dec
Ba	.023v/dec
Rp	1.372E+3 Ohm
E corr,obs	-.349 v
E corr,calc	-.346 v
E-begin	-.358 v
E-end	-.347 v
Corrosion rate	1.028 E-3 mm/year

Table 3. Result of potentiodynamic test in adding corrosive inhibitor material in 100ppm to flour.

I corrosion	8.32 E-9 A
I corrosion	8.32 E-9 A/cm^2
Bc	.009v/dec
Ba	.004v/dec
Rp	1.957E+3 Ohm
E corr,obs	-.252 v
E corr,calc	-.251 v
E-begin	-.256 v
E-end	-.25 v
Corrosion rate	1.955 E-4 mm/year

Table 4. Result of potentiodynamic tests in speed state and adding inhibitor material.

I corrosion	1.304 E-8 A
I corrosion	1.304 E-8 A/cm^2
Bc	.003v/dec
Ba	.002v/dec
Rp	2.123E+3 Ohm
E corr,obs	-.132 v
E corr,calc	-.132 v
E-begin	-.132 v
E-end	-.131 v
Corrosion rate	3.063 E-4 mm/year

7. Conclusion
Reform of electrochemical corrosive data for solution solvency that is not neutral.
Way of current breaking.

Current breaking ways focuses that mass of V_Ω when there is not provide current by ponentiostat (V_Ω is equal to ponentiostat current that multiply in R_Ω time) is zero, and its device for determining that how value of potantio stated potential is provide for non neutral solution Resistance. Potantio stat is planning for breaking potantio stat current in certain interval for short time and measure potential of test electrode when current is zero. Difference between test electrode potential with and without current is potantio stat V_Ω. Potantio stat planning that apply voltage can be compatible with V_Ω value, so Resistant of non neutral solution can become neutral and potantio stat begins or decrease polarization of test electrode and V_Ω form data sets. There is situation that solution Resistant and potantio stat current is very low that V_Ω in insignificant and we don't need to current breaking for correct potential.

7.1 Area of test leered.

3-1- equation stated that we can decrease solution resistance with a) increase of electrode area b) decrease distant between electrodes or c) decrease of solution special resistant. Solution special resistant can decrease with adding water solution and mineral salt. There is limitedness for nearing one reference electrode to test electrode surface. So decrease of reference electrode distant–test doesn't entirely Removal non neutral solution.

7.2. The following results are identified in this article by using experimental results
1) By using various electrochemical tests, we can conclude that potantio dynamic tests prevent useful information in relation to

erosion phenomena when compared with other tests.

2) With increase of banner concentration by electrochemical tests, we can calcite erosion rate and observe its decrease of course in practice, we should gain the amount of optimal injection for erosion banners with consideration to the economical problem.

3) The examination of speed effect on erosion rate with low speed is two fold that from one side it decreases erosion rate because of reaching more banners to the metal surface and from another side it decreases concentrated polarizations because of malting an homogenous solution and also increases erosion rate; so the reaching of revival materials to the surface will increase and also because of increase in solution flow like was shing power of solution, the abrasive erosion will be higher.

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