

Experimental Study of Factors Affecting Corrosion in Gas Wells Using Potantio Acetate and Galvan Acetate Tests

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Abstract- Further deterioration in gas wells due to localized corrosion occurs. The local corrosion under the insulation, the deposits or to be caused by bacteria, 10 to 100 times faster than the corrosion damage is uniform. CO₂ corrosion in gas wells temperature can be divided into three regions: A) Temperature below 140 degrees Fahrenheit (C₆₀) does not protect the product and the level of corrosion caused by severe corrosion exists. B) Above 300 degrees F (C₁₅₀), Mgntayt is formed and the environment unless the presence of large amounts of salt water, is slightly corrosive. C) Between 300-140 degrees Fahrenheit (C₁₅₀₋₆₀) has the ability to protect the metal carbonate product layer does not even need a deterrent. But in the presence of ions such as chloride or hydrogen sulfide, or the destructive effect of high velocity fluid layer may be destroyed. Circumstances of high-speed m / s 10 and turbulent fluid flow, creating a protective layer, it is unstable. Scientists Believes that the growth of iron carbonates (FeCO₃) crystals incomplete causes a small anodic area and the wounded are yellow corrosion, at temperatures above C100 product of pyrite (FeS₂) was created on the metal surface is quite stable in terms of thermodynamic. At lower temperatures the formation of this layer decreases and the corrosion rate increases. Corrosion is usually lower than the concentration in ppm 2000 in the sour wells gas in the range pH 5 to 5 / 6 occurs. In this article discussed about laboratory factors affecting corrosion in gas wells using Potantio acetate and Galvano acetate and Potantio dynamics tests.

Keywords: Gas Wells, Corrosion, Potantioacetate, Galvan Acetate.

I. INTRODUCTION

The high cost of corrosion, the corrosion engineer's concern and its reduction in oil, gas and petrochemical countries is essential, about 10 percent of the cost of producing a barrel of crude oil now costs related to the corrosion industry.

Corrosion rates in the world costs 42 to 80 cents a barrel for crude oil is produced, Specific climatic conditions, history of the country's refineries and oil production, the main factors affecting the cost of corrosion in oil country

II. CORROSION MECHANISM

Gases such as carbon dioxide or acetic acid and other short-chain aliphatic acids may be low or high production. The presence of these gases and acid corrosion control is making the complex problems for wells. Corrosion in oil and gas wells has electrochemical mechanism. When the system reaches a temperature below the dew point, moisture is converted to liquid and large droplets on the tube wall may occur. Water plays the role of electrolyte in the electrochemical reaction. The water itself is not corrosive, when acidic gases such as H₂S and CO₂ are dissolved in water, an acidic environment in the vicinity of the sets that severe corrosion of the steel. The corrosive gases other than oxygen, sometimes in oil wells to gas wells, but the problem are there is no oxygen. H₂S gas source can be found in the layers of sediment, oil and gas products of the reaction process or activity is bacteria. Further deterioration in gas wells due to localized corrosion occurs, the local corrosion under the insulation, the deposits or to be caused by bacteria and 10 to 100 times faster than the corrosion damage is uniform. Another type of corrosion is localized corrosion resulting from defects or FILC. The apparent deterioration in the situation is different. Presence of CO₂ as a needle shaped defects FILC or rupture occurs. CO₂ corrosion in gas wells can be divided into three temperature regions:

A) Temperature below 140 degrees Fahrenheit (C₆₀) does not protect the product and the level of corrosion caused by severe corrosion exists.

B) Above 300 degrees F (C₁₅₀), Mgntayt is formed and the environment unless the presence of large amounts of salt water, is slightly corrosive.

C) Between 300-140 degrees Fahrenheit (C_{150-60}) has the ability to protect the metal carbonate product layer does not even need a deterrent. But in the presence of ions such as chloride or hydrogen sulfide, or the destructive effect of high velocity fluid layer may be destroyed. Circumstances of high-speed m/s 10 and turbulent fluid flow, creating a protective layer, it is unstable. Scientists Believe that the growth of iron carbonates ($FeCO_3$) crystals incomplete causes a small anodic area and the wounded are yellow corrosion, at temperatures above C_{100} product of pyrite (FeS_2) was created on the metal surface is quite stable in terms of thermodynamic, at lower temperatures the formation of this layer decreases and the corrosion rate increases. General corrosion in sour wells (includes gas H_2S) in the concentration of this gas, ppm 2000 and in the range pH 5 to 5 / 6 occurs.

III. FACTORS IN THE CORROSION OF GAS WELLS

Temperature: Effect of fluid temperature corrosion in oil and gas industry in similar chemical environments, Corrosion rate is increased at higher reaction temperature corrosion so often that every 20 degrees Fahrenheit (C_{11}) increasing temperature, the corrosion rate is doubled. Corrosion of steel in corrosive CO_2 gas in the vicinity there are three temperature diets:

A) Low temperature and non-protective iron carbonate C_{60} and the corrosion rate is a function of CO_2 partial pressure.

B) Between temperature and $C_{150-C60}$ almost protective iron carbonate layer is formed and the corrosion rate reaches an acceptable value.

C) C_{150} Mgntayt top layer is formed which completely cover and it is also resistant to high velocities and extreme turbulence and is only sensitive to chloride ions. The combination of these three types of diet excluding salt water, the fluid velocity and the ratio of partial pressure of CO_2 to H_2S gas on the corrosion rate, these factors should also be entered in the protective layer.

Pressure: High pressure gas wells in the gas solubility in liquid corrosive effects. Gas pressure can reach psi 12000. Partial pressure of corrosive gases is an important point. The amounts of corrosion of a well produced by CO_2 are as follows:

- Partial pressure of CO_2 is Less than 7 psi \rightarrow non-corrosive environment.

- Partial pressure of CO_2 between 7-30 psi \rightarrow corrosive environments.

- Partial pressure of CO_2 is 30 psi \rightarrow highly corrosive environments.

The role of Fluid in the Corrosion: Experience shows that the wells have corrosion problems when Water cut in the total amount of fluid in them is more than 85 percent. Of course it has plenty of exceptions. Fluid emulsion of water in the fluid conductivity and efficiency as a conductor affects. Mode of the large amount of water wells (without emulsion) produce more corrosive than water wells with Less water cut and more

emulsions . Many studies have been conducted to determine the corrosive fluid within the well. Brad Bern 20 different wells of the contract and amounts of water and acidic gas CO_2 produced as the variables considered. He found that the amount of water is more productive; the amount of CO_2 is more soluble in the vicinity of the wall and creates more corrosion.

Fluid Velocity: Fluid velocity in the fluid regime and the regime's fundamental role in determining the type of fluid are corrosive and performance inhibitors. Experiments have shown that a diet supplemented fluid and field tests are equal, Mechanism and the corrosion rate was similar in both conditions. Regardless of diet, fluids, in order to evaluate the effect of corrosion rate in the temperature range considered three, The corrosion of CO_2 at low temperature (less than C_{20}) has a range of corrosion depends on the hydrolysis rate of CO_2 And is independent of the speed . Range 20 to 60 ° C. The rate of corrosion is very little because the phase of the reaction is CO_2 . But in high temperature conditions (above C_{150}) that Mgntayt layer is formed. The wear rate of the m/s 15 is also more corrosion product layer without being damaged. Unless there are factors such as chloride ions, so if the temperature is well over C_{150} and chloride ions there is no corrosion of any kind, unless the flow rate of is 15 m/s, but if the temperature is lower than C_{150} is just a well with corrosion. But if there is a well producing at high water, all wells will be affected by corrosion.

Fluid Composition: As mentioned before, the combination of salt water and dissolved solids in terms of the protective layer is effective. Chlorine in water is not corrosive and destructive only in the carbonate layer and the corrosion rate is increased. The presence of condensate in turn will prevent corrosion, even some of the condensate containing natural inhibitors to prevent corrosion, but not local.

Corrosive Gases: CO_2 and H_2S gases, corrosive agents in the oil and gas wells are considered, however, each of these gases alone can protect the right circumstances can produce. For example, hydrogen sulfide gas at high temperature C_{100} product of pyrite (FeS_2) is completely stable, which protects the metal surface. When these two gases are combined effects of corrosion leave the complex, Mr. Dunlop has an opinion on this situation, if the ratio is less than 500 CO_2 to H_2S , sulfide layer is formed. Haslrv Astgman believes in higher temperature conditions, this number (500) is larger, when the partial pressure of CO_2 partial pressure of H_2S is more than 2000. Hydrogen sulfide can't damage to iron carbonate layer.

IV. CORROSION CONTROL METHODS

Check for corrosion protection of pipes and walls of gas wells can be used the following methods:

- A) Creating a durable plastic coating inside the tube
- B) The use of corrosion resistant alloys
- C) The use of non-metallic materials

- D) The stabilizer PH
- E) Corrosion inhibitor injection

V. CORROSION TESTS PERFORMED

It is clear that the shape and size of samples will vary according to the tuberculosis laboratory. It is often better than the surface area to mass is too high and usually square or circular samples with small thickness are used. But all the samples including square, circular or rectangular edge you need to avoid the effects of the metal sheets are cut. If the results obtained should be more uniform layer thickness of the metal surface is removed and rolled to the edge of surface defects, small differences in chemical composition and structure and function caused by the rolling and solve with the other methods. At least 10 to 20 microns should be removed from the metal surface that I have the following advantages: In acid, electro-polishing or grinding the surface with abrasive paper to create subtle, that prevent it being cold. After examining the samples with a typical diameter (1mc) of steel AXL₅LX₅₂ the chemical analysis it was prepared to join the, for rolling and machining is to remove defects, The samples with coarse abrasive grade 40 took the abrasive surface preparation of respectively 800, 400, 200, sample preparation is done.

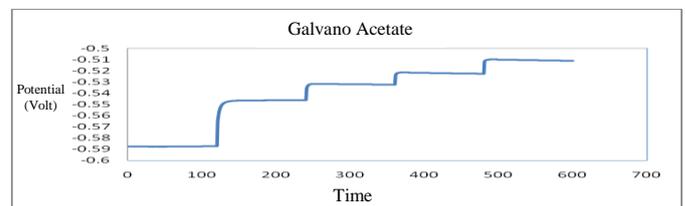
VI. TEST CONDITIONS

Aqueous solution used in the laboratory , Actual water samples from the production fluid and gas field in Iran and Water samples from the injection well chosen that the owner refused to wear the wellhead facilities Corrosion studies of the corrosion rate of fluid can be precisely manufactured and also reduce the corrosion rate in the psychological effects are still. The PH of the solution should be study. Generally it is better not to be blown in the air, unless a solution is needed. If a solution is needed to allow air to be blown to the surface oxygen to the deal, where the reactions take place reducing the oxygen and cause corrosion on the surface, to eliminate air in solution can be use the azot without oxygen, nitrogen and argon. In this experiment, nitrogen out of air from the cylinder must be at least half an hour before the test. Volume of solution should be high enough to reduce the corrosive materials in the experiment and the high accumulation of corrosion products in place to avoid. In these experiments, the solution volume is 500 mL of TB laboratory,($1 \pm ^\circ$ C) temperature must be controlled carefully and Room temperature is 25° C is usually, The temperature should be fixed in the test chamber to create a thermal gradient changes the solubility and the ability to prevent the potential changes. The effect of fluid velocity on the corrosion of a metal sample was used to pump And the appointment of the place was very small laboratory cell output and soluble cell surface can be kept constant laboratory For this purpose, a bypass path from the output of the pump inlet to the pump tank and a path of pump output to the input cell is built The heat pump is used to

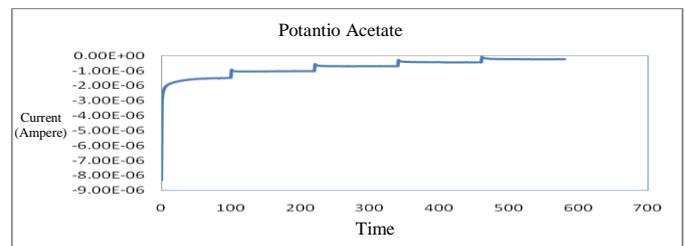
prevent burning at a low capacity pump, and maybe taken. With both the control flow path taken Equipment required for the fluid flow can be seen in the movie, too.

VII. ELECTROCHEMICAL EXPERIMENTS , POTANTIO ACETATE AND GALVANO ACETATE TESTS

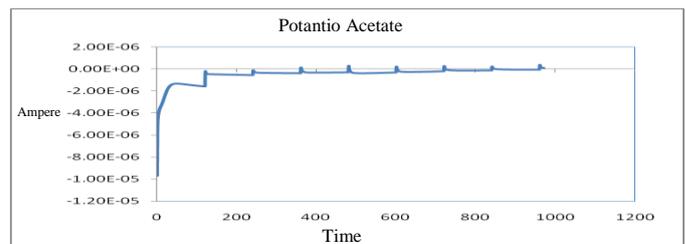
Many different methods for the study of electrochemical corrosion is there but it is clear check all the details that are difficult. In experiments to examine Potantio acetate, Galvano acetate is paid. Consists of an electrode polarization Galvano acetate a predetermined current to the electrode and Register the electrode potential changes with time .by the Way that can be applied as a step or continuous flow increased and potential changes to the polarization curves to be plotted .in this section Step change is considered. Consists of electrode polarization Potantio acetate a predetermined potential to the electrode and register Change with time. By the Way that it can increased acts potential as step or continuously, And changes over time as the polarization curve was plotted. The continuous variation of potential in the previous section entitled Potantio dynamic or Potantio Kinetics evaluated. However, the growth mode of metals that do not should be seen in the current or potential effects and other variables, we will deal with it.



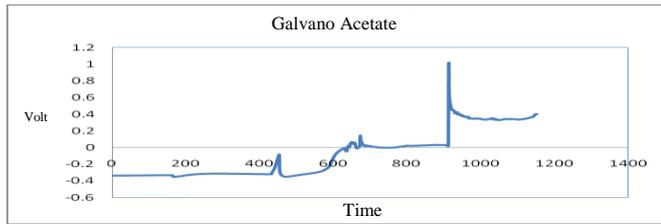
Graphs (1): In Blank- Anti-Corrosion-Free Materials and Fluids in Stationary



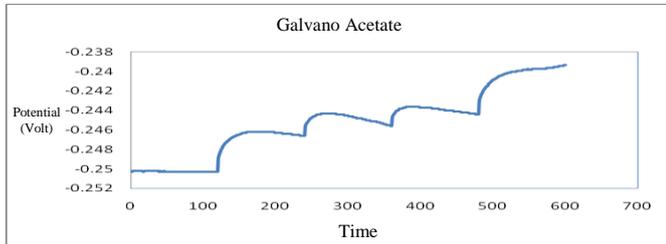
Graphs (2): in Blank- Anti-Corrosion-Free Materials and Fluids in Stationary



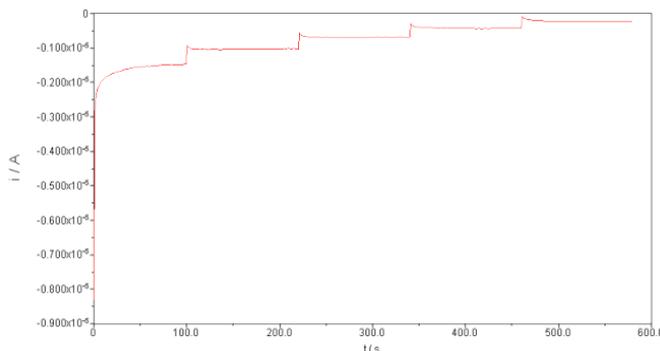
Graph (3): The Corrosion Inhibitor Added to the Amount of Fluid in the 50ppm



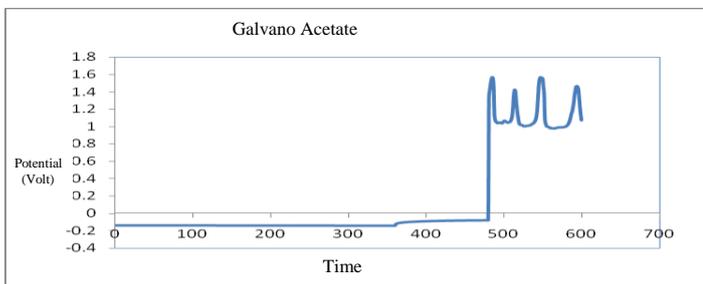
Graph (4): The Corrosion Inhibitor Added to the Amount of Fluid in the 50ppm



Graph (5): In Addition to the Corrosion Inhibiting Amount of Fluid in the 100ppm



Graph (6): The Corrosion Inhibitor Potantio Acetate in Addition to the Amount of Fluid in the 100ppm



Graph (7): The Speed and the Addition of Inhibitors

VIII. CONCLUSION

Polarization Resistance: Corrosion rate of various experiments by the use of inhibitors was tested and In each experiment, the corrosion rate was different Indicating that this is The effect of change static to turbulent, concentration

polarization is reduced and corrosion is increased and the speed of the electrolyte can be beneficial, because the inhibitor to reach the metal surface and the inhibitor can act more effectively.

1) With increasing concentrations of inhibitors by testing the electrochemical corrosion rate can be achieved and see the reducing. However, in practice the optimum injection rate and corrosion inhibitor with respect to the issue of reasonable economic gain.

2) The effect of velocity on corrosion rate at low speeds is a dual On the other hand reduces the corrosion inhibitor material to the metal surface is due to reach more and on the other hand The concentration polarization is reduced, because the solution will be homogeneous and the corrosion rate increases and most of the reduction material reaching to the surface. When the solution is turbulence, because of the washing solution can be increased and the corrosion abrasion is increased too.

3) Using various electrochemical tests reached the conclusion that the Potantio dynamic test in comparison with other tests gets more useful information about Corrosion.

4) With Comparison about Galvano acetate and Potantio acetate can be said: Routine does not find in the case of metals such as current density is determined for each potential , it is indicative Corrosion rate ,Potantio acetate method offers current in each potential is more useful than Galvano acetate method.

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