Drag Reducing Additives as a Corrosion Prevention Method in Turbulent Flow

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Introduction

The serious problematic of present corrosion in the petrochemical sector has originated the development of one of the most important areas in the research of corrosion from the point of view so much economically as of security. For corrosion control diverse protection techniques are used such as the superficial alteration of metals, creating or provoking a protective barrier which it is also a product of the same metal, such as the case of the anodized one[1]. Also, it can be physically isolated to the metal within the media in which it is exposed. This is carried out by means of insulated coverings such as anticorrosive paintings in which the majority of these coatings contain, besides the elements of a conventional painting, substances that actively inhibit the deterioration of a metal due to corrosion, just in case the painting shows a failure such as porosity, fracture[2], etc.

This work describes the behavior of a type of a special additive that is employed in order to reduce speed corrosion in a carbon steel pipeline mainly within oil transportation in turbulent flow and with a focus on their quality, reliability and deliverability. There will also be extensive discussion of the chemistry involved in the target process and effect of this chemical additive and its specific purpose[3]. That purpose being to optimize the oil pipeline transportation performance. Secondly, but still of vital importance, is that any intervention done have minimal environmental impact.

Experimental

The determination of the speed of corrosion depending on the speed of the corrosive medium was carried out by means of potentiodynamic polarization of Tafel's Extrapolation and Resistance to the linear Polarization commonly recounted as Rp. The experimental conditions under which all the tests were carried out using the technology of Tafel's Extrapolation were carried out polarizing the electrode of work beginning 300 mV below the potential of free corrosion (Ecorr) and finishing 300 mV over this one. The speed of sweeping selected was of 1.67 mV s^{-1}. For potentiodynamic polarization tests using the Rp technique, the electrode of work was polarized 20 mV overhead and below the potential of free corrosion, the speed of sweeping selected was of 1.67 mV s^{-1}.

When working with the inhibited system, the test were done by adding 200 ppm of inhibitor, These measurements were carried out changing the speed of rotation of the ECR in increases of 500 rpm, taking place three different measurements for every speed of rotation, beginning to work from static conditions (0 rpm) up to covering the proposed interval. In this case the same corrosive media was used during the whole interval of measurement as well as the same electrode of work.

Results and Discussion

The first table (Table 1) shows the results of corrosion speed for a non-inhibited system depending on the rotational speed of the RCE applying the technique Polarization Resistance for corrosive environment at room temperature where it appears that at static conditions, the current limit of mass transfer is very small and that this is further increased by raising the speed of the corrosive environment.

Table 2 shows the results of speed of corrosion depending on the speed of rotation of the ECR (speed of the aggressive media) using Resistance to the polarization technique to determine the speed of corrosion, In this case for the tests a corrosive media was used at room temperature and in which 200 ppm of inhibitor were added.

Rotational Speed of the RCE (rpm)	Corrosion Speed (mpy)
0	2.571
500	5.077
1000	6.674
1500	8.602
2000	10.22
2500	11.21
3000	12.68
3500	13.97
4000	15.34
4500	16.72
5000	17.4
5500	17.83
6000	18.37
6500	27.56
7000	34.25

Table 1. Corrosion Speed Applying Polarization Resistance for Corrosive Environment at Room Temperature for a Non- Inhibited System

Rotational Speed of the RCE (rpm)	Corrosion Speed (mpy)
0	2.80
500	9.02
1000	9.47
1500	12.32
2000	16.90
2500	18.33
3000	19.57
3500	20.18
4000	22.80
4500	23.64
5000	23.99
5500	24.67
6000	20.21
6500	26.9
7000	27.22
7500	27.72

Table 2. Speed of Corrosion Applying Rp for Corrosive Environment at Room Temperature for an Inhibited System

Conclusions

The Cylindrical Rotating Geometry technique was effective to reproduce turbulent flow. The use of this technique could verify that for the medium used, without inhibitor, an increase in the corrosion speed when increasing the speed of the medium as result of the transport of mass. Inside the interval from 0 to 5500 rpm the corrosion of the steel was inhibited for a cap of products of corrosion formed on the surface of the metal whereas for major speeds an increase was observed in the corrosion speed due to the break of this cap. For the inhibited system, the results showed that the effect of the drag reducing additives increases the speed of corrosion due to the increase in the transfer of mass inside the first speeds of rotation and this one begins to act diminishing the speed of corrosion within the interval where for the non-inhibited system the layer of products of corrosion had been detached.

References

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