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Poster  Oral

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### **Study on the use of N, N'-Methylenebisacrylamide as a corrosion inhibitor of a 1020 steel**

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#### **Extended Abstract**

Corrosive processes cause great economic losses for the industry. Consequently, various methods have been developed over the years to mitigate these losses. One such method is the use of corrosion inhibitors. The development of inhibitors has found wide application in the petroleum industry. In this particular study, an amide compound was investigated as a potential corrosion inhibitor. Previous research has indicated that amides can effectively act as corrosion inhibitors, demonstrating satisfactory inhibition in some cases. To evaluate the performance of this amide, electrochemical analyses were conducted, which involved measuring the open circuit potential and potentiodynamic polarization. The study utilized a AISI 1020 steel material immersed in a solution containing 3.5% NaCl. The analyzes showed an increase in the corrosion resistance of AISI 1020 steel in the amide-containing solution. Therefore, this amide can be used as a corrosion inhibitor.

**Keywords:** corrosion, inhibitor, amide, 1020 steel.

#### **Introduction**

Metals play a significant role in various industrial sectors due to their properties, such as high mechanical strength and relatively low cost. Among metals, AISI 1020 steel is the most widely used in industrial pipeline systems due to its cost-effectiveness and widespread availability. However, these materials can deteriorate when exposed to highly aggressive environments (1, 2, 3).

Corrosion is the primary cause of this deterioration, which has a direct impact on metal equipment and structures. The petroleum industry faces the most severe impacts from corrosive agents, resulting in losses in its production chain, especially due to the exposure of these materials to the marine environment. Consequently, corrosion-related damages result in considerable costs, both direct and indirect. For this reason, it becomes necessary to develop corrosion control methods that demonstrate effectiveness without compromising the environment with harmful substances (1, 4, 5, 6).

Corrosion inhibitors are chemical compounds that are added to a fluid in appropriate concentrations with the aim of mitigating or preventing corrosion. Recently, the industry has shown a growing interest in researching environmentally friendly corrosion inhibitors. This pursuit involves replacing inhibitors containing chromates or compounds formed by heavy metals, which do not comply with environmental regulations (6, 7).

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N,N'-Methylene bisacrylamide is an organic compound used as a crosslinking agent in polyacrylamides. In this study, an amide was investigated as a potential corrosion inhibitor for AISI 1020 steel in a 3.5% NaCl solution. For this purpose, electrochemical techniques such as open-circuit potential measurement and potentiodynamic polarization curve were employed to assess the inhibitory effect of this amide on the steel (8).

## Methodology

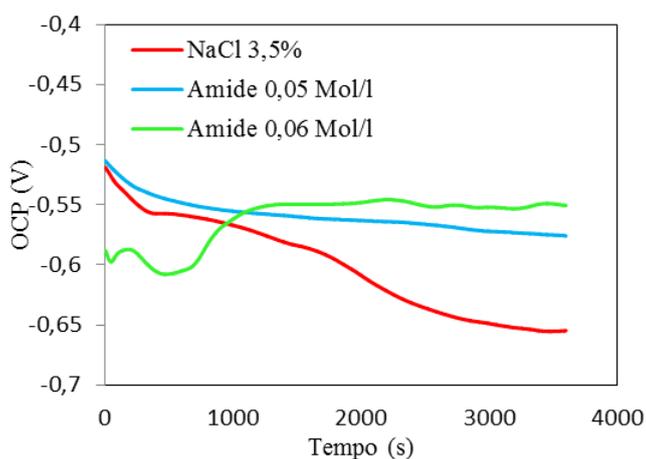
In the present study, samples of AISI 1020 steel were used. The samples were cut, welded to copper wire, embedded in epoxy resins, and polished using polishing papers ranging from 80 to 1200 Mesh. The electrochemical tests conducted included open-circuit potential (OCP) measurements and potentiodynamic polarization curve. The OCP was monitored for 3600 seconds, and for the polarization curve, an overpotential of 700 mV relative to the OCP was applied.

The equipment used for the tests was a potentiostat/galvanostat from the AUTOLAB brand, model PGSTAT 204N. The electrochemical analyses were conducted in an electrolyte with a 3.5% NaCl solution and the addition of concentrations of 0.05 mol/L and 0.06 mol/L of N,N'-methylene bisacrylamide at room temperature.

## Results and discussion

### *OCP – Open circuit potencial*

The open-circuit potential measurement assesses the equilibrium potential between the metal surface and the solution. The values of open-circuit potentials for AISI 1020 steel immersed in a 3.5% NaCl solution with the addition of amide in two different concentrations after 3600 seconds are shown in Figure 1. It can be observed that the OCP value for the steel immersed in a 3.5% NaCl solution presented a more negative value when compared to the two solutions containing amide. The addition of the amide caused a shift in the OCP towards more positive values, indicating a potential inhibitory effect on the metal.

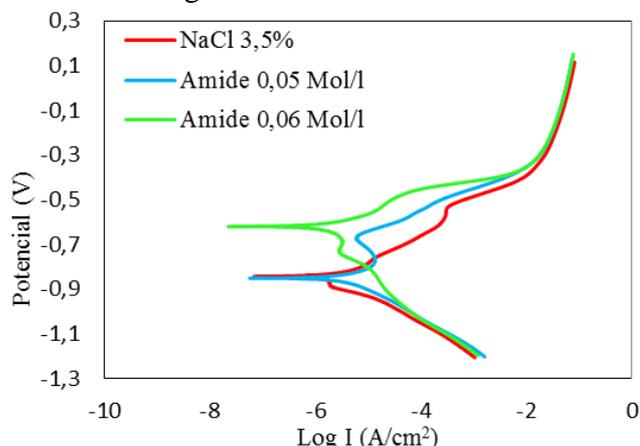


**Figure 1. Open-circuit potential measurements of AISI 1020 steel in different solutions.**

### *Potentiodynamic polarization*

Figure 2 presents the potentiodynamic polarization curves of AISI 1020 steel in solutions containing 3.5% NaCl with the addition of amide at concentrations of 0.05 mol/L and 0.06 mol/L. It can be observed that AISI 1020 steel is a material with low corrosion resistance in a saline environment. There is no presence of a passive region in the curve, making this material susceptible to corrosion. However, it can be noted that the addition of the amide led

to a decrease in the current density value in the anodic region of the curve, with the presence of some passive peaks, indicating that this amide functions as a corrosion inhibitor for this steel. The curve with a concentration of 0.06 mol/L showed the lowest current value in the anodic region and consequently the highest inhibition efficiency. There was no significant variation observed in the cathodic region.



**Figure 2. Potentiodynamic polarization curves of AISI 1020 steel in different solutions.**

## Conclusion

The analyses demonstrated an increase in the corrosion resistance of AISI 1020 steel in the solutions where amide was added. According to the results obtained in the electrochemical analyses, N,N'-methylene bisacrylamide can be used as a corrosion inhibitor for AISI 1020 steel. However, further analyses are necessary to investigate the electrochemical behavior of this amide more comprehensively.

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