Corrosion inhibitors from different organic groups were tested on carbon steel in 0.1 M Cl\textsuperscript{−} contaminated simulated concrete pore solutions (SCPS). It was found that inhibitors possessing π–bond electrons in a functional group had better performance. This is attributed to the high tendency of donating π– electrons to the metal surface. Thus, creating a protective adsorption film during the chemisorption process. Another way to show the significance of this phenomena is by using a quantitative structure-property relationship (QSPR) using Signature descriptors. It was found that the atomic signature fragment that captures π– bond was the most influential corroborating experimental results.

### Introduction

- Chlorides near marine environment diffuse into the concrete matrix creating an autocatalytic acid hydrolysis reaction, decreasing the local pH from 12 to 4, causing pitting corrosion.
- Formation of corrosion products on the surface of carbon steel in concrete causes an increase in volume and pressure. As a result, the concrete will crack and spall, thus losing its structural integrity.
- Many corrosion prevention methods have been introduced. However, corrosion inhibitors are one of the most popular as they are less costly and easy to use.
- Organic inhibitors create an adsorption film on the surface of the carbon steel rebar protecting it from chloride induced pitting corrosion, as seen in the figure below.

### Experimental procedure

- A SCPS (pH=12.6) was used with 0.1M Cl\textsuperscript{−}. The solution was deaerated to simulated buried concrete structures near marine environments.
- Seven 0.1 M inhibitors were used.
- Cyclic potentiodynamic polarization (CPP):
  - Forward/backward scan rate = 0.166 mV/s
  - Start and end potentials = −1.2 V\textsubscript{EC}
  - Current threshold = 2.2 mA/cm\textsuperscript{2}
- Current threshold = 2.2 mA/cm\textsuperscript{2} . The SCPS was used with 0.1M Cl\textsuperscript{−}.

### Results

- Poly-carboxylates increased the pitting potential significantly compared to the reference, as seen in the CPP. Thus, corrosion will be harder to initiate.
- Amines and alkanolamines showed moderate inhibition performance.
- The increased inhibition efficiency in poly-carboxylates is attributed to the presence of π–bond electrons, making the inhibition process easier.

### Conclusion

- Inhibitors possessing π– bond electrons have better anticorrosive properties.
- The QSPR model agrees with the experimental results, showing the importance of π– bond electrons in the inhibition process.

### References