CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)

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Project Number

S0513

Project Title

The Effect of Steel Exposure on Corrosion Rates in an Oil Field Environment

Abstract

Objectives/Goals

To determine the effect of steel exposure in comparison to corrosion rates in simulation of an extreme oil field environment.

Methods/Materials

Five carbon steel corrosion coupons (7.5 cm x 1.2 cm) were coated with epoxy spray paint. One coupon was not coated, one was fully coated, and three had two stripes of exposed metal that were ½ cm, 1 cm, and 2 cm in width. Each metal's mass was then recorded, and the metals were immersed in 200 mL of a 1.60 pH solution of water and muriatic acid. The metals were then exposed to carbon dioxide for five minutes, sealed, and placed in a 170ºF oven for seven days. The exposed metal was then cleaned of any excess rust, and the mass was taken. The process was repeated fifteen times for a total of seventy-five trials.

Results

The non-coated coupon lost an average of .83 g, the 2 cm exposed lost an average of .83 g, the 1 cm exposed lost .91 g, the ½ cm exposed lost 1.18 g, and the fully coated lost 1.32 g. The effects of pitting corrosion were most noticeable on the metals as the exposed surface area decreased.

Conclusions/Discussion

Our hypothesis was not supported by the data. As the surface area exposure decreased, the metal exhibited more concentrated corrosion and increased corrosion rates. If the results continued, the non-coated coupon was projected to last 88 days before it was fully penetrated, the 2 cm exposed would last 88 days, the 1 cm exposed would last 81 days, the ½ cm exposed would last 62 days, and the fully coated would last 56 days. This proves that under-deposit corrosion (corrosion which occurs between a protective deposit and the metallic surface) has a faster corrosion rate and increased pitting corrosion on the coupons that were fully coated. Since the tests in this experiment were run under extreme conditions, further investigation must be done to prove that the results would be consistent in all oil field environments. However, these results show that an oil company should either invest in a good coating or not coat the metals at all. Cheaply coated metal is susceptible to greater pitting corrosion and earlier replacement.

Summary Statement

To determine the effect of steel exposure in comparison to corrosion rates in simulation of an extreme oil field environment.

Help Received

Mr. and Mrs. Peter Okita helped with project ideas as well as supplied the room to run our experiment. Mr. Jim Griffin provided us with the steel coupons.