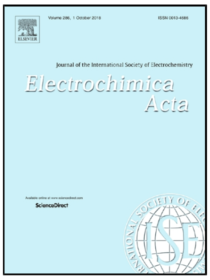

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Near Surface pH Measurements in Aqueous CO_2 Corrosion

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Abstract

Corrosion of carbon steels in a carbon dioxide (CO_2) corrosive environment is an important issue and in some cases the steel surface can be covered by a protective corrosion product film. Research has shown that under certain conditions, once a truly protective film has precipitated on the steel surface, the corrosion rate can decrease by an order of magnitude. Over many years, both quantitative and qualitative research has been carried out to further understand the initiation and growth of the protective film. However, a main limitation is in the correlation of film properties with bulk solution conditions. Research has shown that serious errors in predicting/ reasoning can be made by operating with bulk instead of surface water chemistry conditions. This paper uses a pH sensor design to be used for real time surface pH measurement. The study shows a simultaneous electrochemical and surface pH analysis at two varying conditions of pH (pH 6 and pH 6.6) where a characteristic difference in the morphology and hence protectiveness of a corrosion product film is anticipated.

1. Introduction

The formation and development of corrosion product films on a metal surface is essential to corrosion science. A “protective film” can cause a significant reduction in the corrosion rate by blocking the underlying steel from further dissolution. However, local defects or damage in the corrosion product film/scale covered surface can lead to severe localised corrosion by exposing the underlying metal to the aggressive corrosion environment [1]. Over the years,