Atmospheric Corrosion Investigations of Iron and Copper Using Quartz Crystal Microbalance

Abdulaziz Alghyamah and Maher Alodan
Chemical Engineering Department
King Saud University
Riyadh 11421
alodan@ksu.edu.sa

Abstract

Metals are more frequently exposed to different gas phases (including the atmosphere) than any other corrosive environment. Atmospheric corrosion has been identified as one of the oldest forms of gas phase corrosion and has been reported to account for more failures than any single environment. The corrosion characteristics of the atmosphere are influenced by many variables including relative humidity, temperature, air pollutants, wind speed and direction and the distance from the coast. The severity of atmospheric corrosion tends to vary significantly among different locations, and generally the industrial atmosphere is the most corrosive environment primarily because of the sulfur compounds produced during the burning of sulfur containing fuels.

Different techniques are available to measure and characterize gas phase and atmospheric corrosion. The quartz crystal microbalance is a very sensitive technique to measure minute mass changes with a mass resolution of around 18 ng/cm^2. This capability of the QCM suggests that it can be used to study atmospheric and gas phase corrosion.

The main objectives of this study are to develop a set-up that measures gas phase corrosion rate in a simulated atmosphere using the QCM, mainly to study the effect of air pollutants (mainly sulfur dioxide and nitrogen dioxide) on the corrosion rate of iron in different temperatures and relative humidities. Obtained results show that corrosion of iron is very sensitive to relative humidity and temperature. Added pollutants also show significant effect on the build up of corrosion products.