Application of Bi-polar Electrochemistry Approach to Characterise the Corrosion Behaviour of Type 420 Stainless Steel

Yiqi ZHOU[1], Dirk ENGELBERG[1]

[1] *University of Manchester, United Kingdom*

A bi-polar electrochemistry approach has been applied to characterise the corrosion behavior of Type 420 stainless steel in HCl containing environment. Bi-polar electrochemistry can provide the full spectrum of a potentiodynamic polarisation response on one sample, spanning from cathodic polarization reactions at one side, to the anodic polarization response at the other side of the sample. Different HCl concentrations were explored to optimise the experimental set-up for probing uniform and localized corrosion kinetics, using chrono-ampero-metric or chrono-potentio-metric control. The local corrosion response of Type 420 stainless steel was then characterized by laser surface confocal microscopy, providing information about corrosion kinetic behaviour as a function of applied potential and environment.

Bi-polar electrochemistry exposure to 1 M HCl resulted in a uniform corrosion gradient, balanced by a large cathodic region. Exposure to 10^{-1}M HCl resulted in pitting corrosion surrounded by uniform corrosion, also balanced by a large cathodic region. Experiments in 10^{-2}M HCl showed pitting corrosion spatially separated by a region of uniform corrosion, and the corresponding cathodic region. The results of this study are discussed in light of pit growth kinetics and the uniform corrosion behaviour of Type 420 stainless steel.