EVALUATION OF CORROSION CO-INHIBITION CHARACTERISTICS OF SODIUM TUNGSTATE WITH SODIUM NITRATE, SODIUM SILICATE AND POTASSIUM IODIDE ON LOW CARBON STEEL IN HYDROCHLORIC ACID

By

Olasupo Ogundare

B. Eng. (Hons), F.U.T.Akure, 2000

A THESIS SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF SCIENCE DEGREE, (M.Sc) IN MATERIALS ENGINEERING, DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING, OBAFEMI AWOLOWO UNIVERSITY, ILE-IFE, NIGERIA.

ABSTRACT

This study has investigated the corrosion co-inhibition characteristics of sodium tungstate with sodium nitrate, sodium silicate and potassium iodide on low carbon steel in 0.085 M hydrochloric acid. This was done with a view to determining which of the oxidizing inhibitors would produce the highest co-inhibition efficiency with sodium tungstate.

The inhibition study was carried out using the weight loss immersion technique. The inhibitive potentials of the inhibitors were based on the determination of the corrosion rates, pH of corrosive media and a calculation of the inhibitive efficiencies of the different inhibitors at various levels of concentrations. The adsorption mechanisms of the individual inhibitor and co- inhibitors were determined by various adsorption isotherms for calculating degree of surface coverage with concentration. The uninhibited solution of 0.085 M hydrochloric acid served as the control. The effects of individual inhibitor and co-inhibitors on corrosion rates (mpy) and inhibition efficiencies, pH changes and corrosion potentials at 50 ppm, 100 ppm and 200 ppm concentrations with time of exposure in 0.085 M hydrochloric acid were investigated.

The results showed that inhibitive efficiencies of 71% were produced by co-inhibiting sodium tungstate with sodium silicate when compared to 54% produced by co-inhibiting with sodium nitrate after 336 hours of exposure. The co-inhibition of 50 ppm sodium tungstate with 100 ppm sodium silicate was observed to be the optimum concentration. Potassium iodide used alone as inhibitor was observed to follow the Langmuir isotherm mechanism of adsorption. The co-inhibition of sodium tungstate and potassium iodide as well as sodium tungstate and sodium nitrate followed the Freundlich

isotherm. The corrosion potential change of the test medium was observed to confer a corresponding change in pH. The trend observed was that as the pH values increased, the corrosion potentials of the medium decreased.

The study concluded that the inhibition efficiency of sodium tungstate in hydrochloric acid would be greatly enhanced if sodium silicate were added to the acid-inhibitor medium at the optimum quantity.