CHAPTER 5

SUMMARY AND CONCLUSIONS

The solubility of polymers is an important factor to consider it for the commercial applications in industries. So in present investigation, polyaniline (synthesized and characterized in the Lab) is chosen for studying its inhibitive properties in 2M NaOH solution.

a. **Inhibitive effect of zinc oxide on the corrosion of 57S aluminium alloy in alkaline 2M NaOH medium**

The inhibitive effect of zinc oxide for 57S aluminium in 2M NaOH is studied by the electrochemical techniques such as impedance and Tafel polarization techniques. Further, the morphology of the 57S aluminium electrode in the presence of inhibitor is studied through Scanning Electron Microscope (SEM) and (X-Ray Diffractometer).

a) The inhibitor efficiencies (I.E) of zinc oxide are found to be increased with increase of concentration of zinc oxide. A concentration of 300 ppm ZnO is found to be more effective than other concentrations of polyaniline for 57S aluminium in 2M NaOH solution.

b) The high percentage of anode efficiency in 2M NaOH by 0.2M ZnO is indicative of more protective nature of ZnO on the aluminium electrode surface.

c) From the SEM morphology of the anode, the corrosion attack in the presence of zinc oxide is very less than in its absence.
d) In NaOH +ZnO, XRD data suggest that presence of only zinc oxide. There may be a formation of a layer on aluminium.

A comparison of peak height with that obtained from ASTM standards brings out the fact that, surface of the corroded metal indicates the presence of manganese as manganese hydroxide. This fact may responsible for the slight inferior performance of 57S as galvanic anode in the alkaline zincate solution.

e) The inhibitive nature is mainly due to the adsorption of zinc oxide on 57S aluminium surface.

f) The electrochemical studies of the zinc oxide reveal that the inhibition efficiency of high concentration of zinc oxide in 2M NaOH solution is increased with increase of concentrations of the zinc oxide in 2M NaOH +ZnO solution.

g) The order of the inhibition effect of concentration on zinc oxide is found to be 300 > 200 > 100ppm

b. Inhibitive effect of zinc oxide and various concentrations of polyaniline on the corrosion of 57S aluminium alloy in alkaline 2M NaOH medium

The inhibitive effect of polyaniline for 57S aluminium in 2M NaOH by 0.2M ZnO and polyaniline at the various concentrations is studied by the electrochemical techniques such as impedance and Tafel polarization techniques. Further, the morphology of the 57S aluminium electrode in the presence of inhibitor is studied through Scanning Electron Microscope (SEM) and (X-Ray Diffractometer).
a) The inhibitor efficiencies (I.E) of polyaniline are found to be increased with increase of concentration of inhibitors to the extent of 100ppm to 700ppm. At 800ppm concentration the inhibitor coating peels off. A concentration of 700ppm of polyaniline is found to be more effective than other concentrations of polyaniline for 57S aluminium in 2M NaOH solution.

b) The \( i_{corr} \) value for 57S is found to be decreased from 1.49mA to 592\( \mu \)A for a concentration range from 600 ppm to 700ppm of polyaniline.

c) As there is no significant variation in \( E_{corr} \) values in the presence of inhibitors, it suggests that these compounds behave as mixed type of inhibitors. The results obtained from impedance, Tafel polarization methods are found to agree very well.

d) The high percentage of anode efficiency in 2M NaOH by 0.2M ZnO and polyaniline at the various concentrations is indicative of more protective nature of inhibitors on the aluminium electrode surface.

e) From the SEM morphology of the anode the corrosion attack in the presence of polyaniline is very less in comparison with the attack in presence of Zinc oxide in 2M NaOH solution.

f) In NaOH +ZnO+700 ppm of polyaniline, XRD data suggests that presence of only polyaniline. There may be a formation of two layers on aluminium. The outer layer may consist of
polyaniline while the inner layer closer to the metal may be oxides of magnesium, zinc and aluminium.

g) The inhibitive nature is mainly due to the adsorption of polyaniline on 57S aluminium surface.

h) The electrochemical studies of the polyaniline reveal that the inhibition efficiency of high concentration of polyaniline in 2M NaOH solution is increased with increase of concentrations of the polyaniline in 2M NaOH solution.

i) The order of the inhibition effect of concentration on polyaniline is found to be 700 > 600 > 500ppm

c. Comparison between the better performances of polyaniline coated specimen of 57S grade aluminium with zincated specimen of 57S grade aluminium.

1. Surface modified 57S Aluminium alloy at different concentrations of ZnO and polyaniline has been prepared and characterized. Self-corrosion rate of 57S aluminium containing (97.7% Al, 2% Mn and 0.03% Mg) in 2M Sodium Hydroxide containing 0.2M Zinc Oxide and 700 ppm of Polyaniline has been found to be minimized.

2. A solution of 2M NaOH containing 0.2M ZnO and 700 ppm concentration of polyaniline in NMP solution for 57S aluminium is found to show minimum self corrosion followed by other concentrations in the following order

500ppm>600ppm>700ppm of polyaniline
3. In the case of polyaniline coated specimen of 57S grade aluminium showed better performance than that of zincated specimen of 57S grade aluminium.

4. 57S aluminium in 2M NaOH containing 0.2M ZnO and 700 ppm concentration of polyaniline in NMP solution was found to show high negative open circuit potential, minimum self corrosion and low anodic polarization and high anode efficiency compared with 57S aluminium in 2M NaOH containing 0.2M ZnO.

5. A better performance of 57S in alkaline (zinc oxide + polyaniline) solutions can be ascribed due to the formation of polyaniline layer over the aluminium zincated substrate. This assumption can be substantiated by x-ray diffraction studies.

6. Polyaniline was found to improve the performance of 57S aluminium as galvanic anodes in alkaline (zinc oxide+polyaniline) solutions.

7. Additions of 0.2 M ZnO inhibited the corrosion of 57S aluminium in 2M NaOH solution. 700 ppm of polyaniline in NMP solutions and 0.2M ZnO offered enhanced inhibition. The formation of ZnO incorporated with polyaniline inhibited the corrosion of 57S aluminium.

d. Comparing the better performance of anode showing high negative open circuit potential, minimum self corrosion and low anodic polarization and high anode efficiency.
Zinc oxide and polyaniline coating on aluminium was characterized by high negative open circuit potential, minimal self corrosion, low anodic polarization and high anode efficiency.

A good galvanic anode should possess a high negative open circuit potential, minimal self corrosion, low anodic polarization and high anode efficiency. Based on these requirements 57S commercial grade of aluminum could be considered as suitable anode materials for galvanic anodes in 2M NaOH containing 0.2M ZnO and 700 ppm of polyaniline. The aluminium 57S was preferred because of the fact that it had more favourable electrochemical characteristics based on this work.