CHAPTER 7

SUMMARY AND SUGGESTIONS FOR FUTURE WORK

7.1 INTRODUCTION

This chapter of the thesis summarizes the important observations and includes suggestions for the future research.

7.2 SUMMARY

Detailed study was carried out on the effect of surface roughness and surface nanostructuring on hot corrosion behavior of the superalloy IN718 at 600 and 700°C in 1S, 2SM and 3SM. Effect of pre-hot corrosion on HCF behavior of the superalloy IN718 was investigated in the 3SM environment at 600°C. Also, HCF behavior was studied under symmetric and asymmetric loading at 600°C. The major findings are concluded in the subsequent sections.

7.2.1 HOT CORROSION

Hot corrosion behavior at 600°C

a) Hot corrosion was found to increase with roughness of the surface due to increase in the surface area for corrosive attack. Corrosion rate was found to be highest for the 1S coated sample followed by those coated with 3SM and 2SM respectively, due to presence of highly volatile chlorides in the case of 1S and 3SM.

b) In general, corrosion kinetics was lower in the specimens subjected to USP treatment because of the Cr rich oxide and nanostructure on the surface.

Hot corrosion behavior at 700ºC

(a) The sample coated with salt 1S exhibited higher weight gain at 700ºC from exposure of 100 h as compared with the samples coated with the salt mixtures 2SM and 3SM. Also, the sample with higher roughness had higher dislocation density and exhibited higher rate of corrosion.

(b) The highly damaging low melting compound of $NaVO_3$ increased the severity of corrosion of the sample coated with 2SM, enhancing the dissolution of the protective oxide layer.

(c) Ultrasonic shot peening improved the hot corrosion resistance of the superalloy IN718 in the salt mixture 2SM at 700ºC, promoting formation of highly protective layer of Cr_2O_3.

7.2.2 HIGH CYCLE FATIGUE BEHAVIOR

Effect of pre hot corrosion on high cycle fatigue behavior at 600ºC

(a) Lower high cycle fatigue resistance of the pre hot corroded samples in 3SM at 600ºC for 100 h, and tested in HCF at 600ºC, was attributed to pit formation due to evaporation of volatile chlorides, and hence early fatigue crack initiation and rapid crack propagation.

(b) There was significant reduction in fatigue life of the pre hot corroded sample over the entire range of the stress amplitude. The rate of crack propagation was higher in the pre hot corroded samples.

Effect of stress ratio and mean stress on high cycle fatigue behavior at 600ºC

a) The fatigue strength corresponding to 10^7 cycles was around 550 MPa under symmetric loading (R= -1), on the other hand under asymmetric loading fatigue strength was reduced to 234 and 124 MPa for R = 0.5 and 0.7 respectively.

b) The decrease in fatigue life due to tensile mean stress was attributed to multiple crack initiation sites at the surface. The fatigue crack propagation from the surface of the specimen was revealed by striations.

c) At higher mean stress (R = 0.7) the decrease in fatigue life was attributed to multiple crack initiation sites and ratcheting effect resulting from accumulation of plastic strain.

7.3 SUGGESTIONS FOR FUTURE WORK

The following suggestions are made for future work based on the present investigations:

a) Isothermal hot corrosion behavior of the superalloy IN718 at 600 and 700°C.

b) Effect of hot corrosion, mean stress and stress ratio on HCF life of the superalloy IN718 at 700°C.

c) Effect of surface nanostructuring on high cycle fatigue life of the superalloy IN718 at 600 and 700°C.

d) Stability of nanostructure on the superalloy IN718 with increase in temperature and duration of exposure.