

CHAPTER 8
SUMMARY
AND
SUGGESTIONS FOR FUTURE WORK

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8.1. INTRODUCTION

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

8.2. SUMMARY

A detailed study was carried out on the cyclic and isothermal oxidation/corrosion of the SASS 904L at 500, 550, 600 and 650 °C in air for 100 h. Hot corrosion behavior of the 904L was studied under two salt mixtures SM1 and SM2 with the Cl:S ratio of 40:60 and 60:40 respectively. The major findings are concluded in the subsequent sections.

8.2.1 OXIDATION STUDY

- The variation of weight gain per unit area (ΔW) with the duration of exposure in air at 500-650 °C showed parabolic nature. The parabolic rate constant increased with temperature of exposure.
- The weight gain under cyclic exposure in air was appreciably higher than that from the isothermal exposure at the respective temperatures.
- It was revealed by XRD of the oxidized samples that while there was formation of Cr_2O_3 and $\text{Fe}_2\text{O}_3/\text{Fe}_3\text{O}_4$ at the lower temperatures of exposure (500-550 °C) there was dominance of $(\text{Fe,Cr})_2\text{O}_3$ and many other spinels at higher temperatures of exposure (600-650 °C).

- Varying morphology of the oxide scale developed with rise in temperature and the duration of exposure.
- Cross sectional analysis of the oxidized samples did not show any sign of internal oxidation.
- Weight gain was much faster under cyclic exposure during the initial period of exposure and was drastically reduced during longer exposures.
- Dual slope was observed in the plot of ΔW^2 vs t under cyclic exposure at all the temperatures. There was marked increase in k_p values with rise in temperature corresponding to initial stage of oxidation.
- Based on EPMA analysis of cross sections of the oxidized samples a model was proposed for the mechanism of oxidation under cyclic exposure.

8.2.2 HOT CORROSION BEHAVIOR

- The severity of hot corrosion due to the salt mixture SM2 with Cl:S ratio of 60:40 was much higher than that from the SM1 with Cl:S ratio of 40:60 at the temperatures of exposure from 550 to 650 °C.
- The damage from hot corrosion due to SM1 and SM2 was quite less at 500 °C.
- Hot corrosion from both SM1 as well as SM2 was more damaging under cyclic exposure as compared with that of isothermal exposure.
- Cl⁻ ions were quite damaging for the Cr₂O₃ layer and there was active oxidation at 650 °C and formation of chlorides.
- Different morphology of the corroded surface developed, depending on the coating of SM1 and SM2, temperature and duration of exposure.

- There was spallation due to SM2 at 650 °C and also tendency for internal oxidation.

8.3. SUGGESTIONS FOR FUTURE WORK

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

1. Both oxidation as well as hot corrosion tests with SM1 and SM2 coatings, under isothermal and cyclic exposure should be conducted at 500-650 °C for much longer durations of 500 to 1000 h.
2. Some components might go under cold working during fabrication, therefore the effect of cold rolling may be studied on oxidation and hot corrosion behavior.
3. The effect of surface treatment like ultrasonic shot peening for different durations could be studied on the oxidation and hot corrosion behavior.
4. The effect of flowing air and humidity on oxidation behavior may be studied.
5. The effect of heavy salts based on Pb, Zn, Ca and Si, which are insoluble in water and cannot be deposited by spraying, can be studied on hot corrosion behavior.