CHAPTER - 6

CONCLUSIONS

1. 10 Ni 22 Cr coupon (Low Ni) welded with 1.5 KJ/mm H.I produced fine grained austenite in the fusion zone with 40 % ferrite (Approximate FN 30), also indicated fair values of micro hardness of 280 VHN with respect to 270-280 VHN Base metal hardness values.

2. 12 Ni 22 Cr coupon (High Ni) welded with average 1.3 KJ/mm H.I was supposed to suppress ferrite to austenite diffusion due to fast cooling involved in thermal cycle but 11.5-12.5 wt.% enriched (Low nickel) content in electrode succeeded in promoting up to 85wt. % austenite (15 % Ferrite content).

3. It can be concluded that H.I. has least role in controlling the microstructure when welding UNS S 32205 (modified version of grade UNS S 31803), because of presence of min 0.14 wt %. Nitrogen in base metal (Max. 0.20 wt. %). All Samples welded between 1.0-1.5 KJ/mm did not show significant effect on mechanical strength.

4. This can also be justified through metallurgical point of view that Nitrogen being smaller atom compared to Fe, Cr, Ni, and Mn atoms, diffuses faster in austenite from ferrite than other alloying element thereby enhancing the austenite promotion at comparatively higher temperature during cooling from ferrite.

5. Yield strength and tensile strength requirements of base metal and filler metal classifications are exceeded at all ferrite levels 20-40 FN, (15% to 35 % Ferrite) investigated.

6. No Chloride Stress Corrosion Cracking observed after 1000 hours exposure at 12% nickel and ferrite level below 15%.

7. Weld test coupons with 11 % nickel content exhibited typical Chloride Stress corrosion crack- typical " Branch like crack",- which is assumed to be due to presence of continuous network of ferrite on austenitic grains. Crack

propagation is expectedly occurring through this continuous network of ferrite, this common phenomena is reported in many literatures.

8. No pitting corrosion was observed after 24 hrs of exposure in 6 % $FeCl_3$ test solutions at 22 °C for all ferrite levels examined.

9. Minimum ferrite requirements in fabrication specifications can be relaxed according to the findings of this study.

10. Through this research work, the rejections of fabrications can be reduced on account of low ferrite content issue and hence, it helps in economic benefits.

11. Any disputes in selection of filler metal / electrode can be reduced and hence overall reduction in production down time.

12. Nickel is a costly element so through research work, it is not suggested to increase the nickel content in filler /electrode composition to achieve proper austenite formation in weld metal but the purpose of this study is to demonstrate the effect of minimum ferrite level that can meet requirement of resistance to chloride induced stress corrosion, Pitting Corrosion and Mechanical –Tensile and impact strength.

13. Ferrite percentage measurement by metallographic methods seems to be highly variable, depends on the ferrite -austenite grains morphology, distribution of phases, metallographic techniques and expertise of the user.

14. The final weld metal composition, i.e. ferrite content and hence properties, mainly depend on the quantity of dilution that takes place during welding.

15. Ferrite measurements taken on the top surface centreline of any given weld pass shows more consistent and accurate results than reading taken on weld cross section.

16. The accuracy of predictive methods such as WRC 1992 Diagram depends on a chemical composition of base metal, filler metal and weld metal dilution.

17. Predictive methods can be applied where different filler metals of varied chemical composition are to be tested for the weld metal composition before actual welds.

18. Ferrite measurement, with an instrument calibrated according to ISO 8249, is preferred to ferrite prediction.

19. Suitable guideline regarding location and method of ferrite measurement should be provided from the customer to the fabricator/ filler metal manufacturers to avoid any disagreements in ferrite measurement values.