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Investigation of 316L Stainless Steel by Flame Hardening Process

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Abstract**—** *Austenitic stainless steel offer great imperviousness to general erosion because of the development of a detached surface film. They are broadly utilized as a part of the sustenance and concoction preparing ventures and in addition in biomaterial applications. In any case, they can experience the ill effects of setting erosion in chloride particle containing arrangements. All things considered, in the meantime they have discovered little use in mechanical building applications in view of their low hardness and poor wear resistance. In this examination work, to enhance the previously mentioned reasons, surface solidifying by Flame hardening procedure is done. It has for some time been an outstanding a warm treatment for enhancing the surface properties of austenitic stainless steel. The examples were fire solidified for 5 minutes, 10 minutes and 15 minutes separately. Wear test for every one of the examples were completed by stick on plate testing process. The outcomes were contrasted and an untreated specimen and finished up with metallographic tests like optical tiny tests and examining electron magnifying lens tests.*
Keywords**—** *Austenitic Stainless Steel, Poor Wear Resistance Flame Hardening*.

I. INTRODUCTION

Low temperature flame hardening can create another stage with high hardness and great consumption resistance on austenitic stainless steel surfaces. It does as such by the development of a non balance super immersed layer, what is called S-stage or extended austenite stage. The surface layer as being hard and erosion resistance with anticorrosion properties are proportional to the first material. Numerous specialists have created such altered layer on austenitic stainless steels by different warmth treatment forms at low temperatures (<450º c). It is by and large suspected that high temperature treatment may bring about to build more fragility with more hardness, which may prompt disappointment of material. Precipitation of lower carbon content in the stainless material will enhance slight hardness.

II. EXPERIMENTAL WORK

AISI 316L Stainless steel were subjected to flame hardening processes. Three samples were prepared by mechanical cutting of bulk material to disc of diameter 100 mm and 10 mm thickness with ±0.05mmdimensional accuracy. The samples were mechanically polished using SiC abrasive paper from coarse to fine grade following standard polishing procedures. The samples were finally cleaned ultrasonically. Three samples were subjected to flame hardening process where oxy acetylene gases are diffused into stainless steel specimen.

III. WEAR TEST

Pin on disc apparatus were used to conduct the wear test. The samples undergone with heat treatment are undergone under pin on disc testing apparatus. Stainless steel Disc of diameter 100 mm and thickness of 10 mm were subjected to flame hardening process. The pin specimens were replaced one by one against the disc specimen. The disc is rotated to a constant speed of 1000 rpm and the pins were replaced with one by one with a time gap of 2 minutes.

IV. METALLOGRAPHIC TESTS

4.1 Optical Microscope Results

Fig 4.1: *Untreated* Sample - No Case Depth

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Fig.4.2: Flame hardening - 5 minutes 12µm

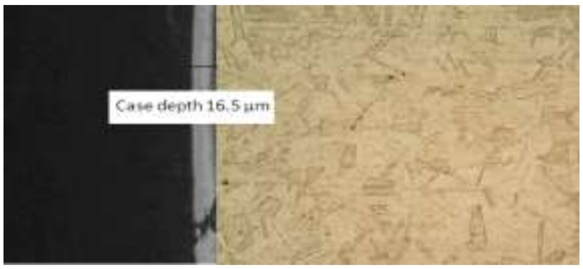

Fig.4.3: Flame hardening - 10 minutes 16.5µm

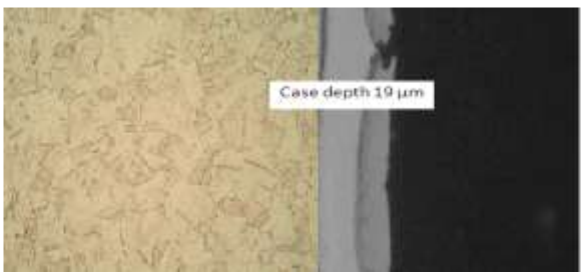

Fig.4.4: Flame hardening - 15 minutes 19µm

From the above diagram, it is clearly seen that, untreated stainless steel sample doesn't have any case hardness value, while the flame hardened specimens were found to be 12 µm, 16.5 µm and 19 µm respectively. The hardness of the material were determined. The hardness for an untreated sample was found to be 330 H_V. While the hardness for the heat treated specimens were found to be 560 $H_{V,}$ 589 $H_{V,}$ 603 $H_{V.}$

4.2 Scanning Electron Microscope Results:

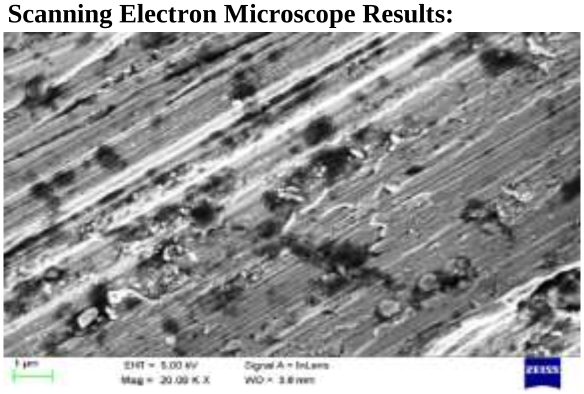

Fig.5: Untreated specimen SEM image

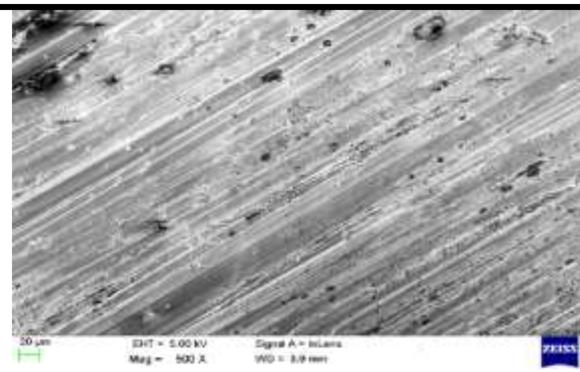

Fig.4.6: Flame hardening - 5 min SEM image

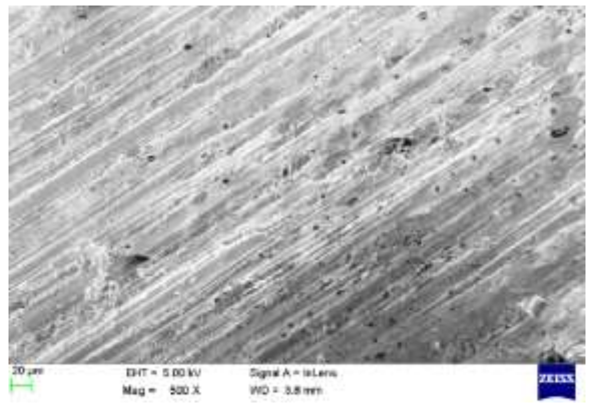

Fig.4.7: Flame hardening - 10 min SEM image

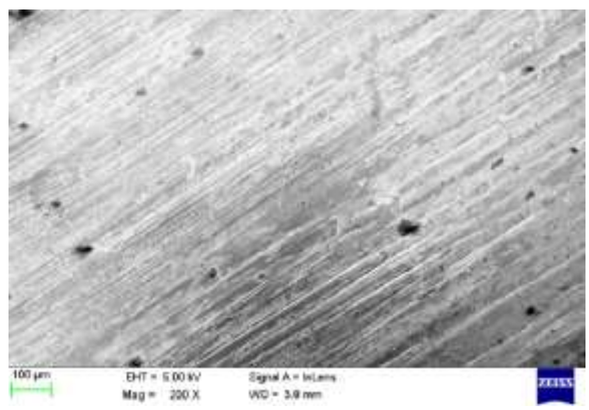

Fig.4.8: Flame hardening - 15 min SEM image

From the wear test results, it is noted that more wear has occurred in untreated sample, where as peel of material gradually decreases as the time of heat treatment process increases. There by wear resistance and hardness are improved, ductility on stainless steel material is enhanced.

V. CONCLUSION

From the research work, flame hardenings on stainless steel were being carried out at various timing parameters. Flame hardening improves the hardness of stainless steel material, improve wear resistance. So that ductility is promoted in

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stainless steel material. So that stainless steel material can be used for higher applications like power plant turbine blades, automobile components, marine applications were components are subjected to salt water.

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