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Dry Sliding Wear Resistance Investigation of 316L by Flame Hardening Process

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Abstract: *The undertaking researches on flame hardening process keeping in mind the end goal to enhance the wear conduct of the material. Flame hardening process were done to 3 distinct examples – 1 minutes, 3 minutes and 5 minutes and named as FH1, FH2, and FH3. A pin on disc apparatus is utilized to direct wear test, with the goal that wear misfortune can be resolved. The examples are to be amplified by metallographic test, for example, optical microscope and scanning electron microscope. The untreated example is utilized to contrast and the treated example. The best example is picked which decides the life of material and enhances the better wear resistance. The hardness of untreated material and treated material were analyzed.*
Keywords: *Flame hardening, Metallographic test, Wear resistance.*

I. Introduction:

Stainless steels are present day materials. Stainless steel is the non specific name for various diverse steels utilized fundamentally for their imperviousness to erosion. Stainless steel is not a solitary material but rather the name for a group of erosion resistance steel in metallurgy, stainless steel is characterized as a ferrous combination with at least 10% chromium content. The name begins from the way that stainless steel does not recolor, consume or rust as effectively as common steel. This material is likewise called erosion safe steel when it is not point by point precisely to its combination sort and grade, especially in the flight business. Accordingly, there are presently unique and effectively open evaluations and surface completions of stainless steel, to suit nature to which the material will be subjected lifetime.

It comprises of chromium (16-26%), nickel (6-12%) and press. Other alloying components (e.g. molybdenum) might be added or altered by the coveted properties to create subsidiary evaluations that are characterized in the models (e.g. 1.4404). The austenitic gathering contains more evaluations, that are utilized as a part of more prominent amounts, than some other class of stainless steel.

AISI 316L austenitic stainless steel is outstanding for its best parity of carbon, chromium, nickel and molybdenum for consumption resistance. In this way, this material is regularly utilized for high temperature conditions, forcefully destructive condition and atomic reactor applications. Be that as it may, a moderately low hardness (200 HV), coming about in the poor wear resistance, is a critical impediment of this steel, that is the explanation behind its restricted utilize. Under states of calculable mechanical wear (glue or grating), this material ought to be described by reasonable wear insurance. An austenitic structure, which can't be solidified by the ordinary warmth treatment, causes that there is no simple approach to enhance the wear resistance of this steel.

II. Experimental Details:

Flame hardening is a surface-solidifying technique that includes warming a metal with a high-temperature fire, trailed by extinguishing. It is utilized on medium carbon, gentle or composite steels or cast iron to create a hard, wear-safe surface. Flame hardening utilizes coordinate impingement of an oxy-gas fire onto a characterized surface territory.

Flame hardening is a quick, efficient strategy for specifically solidifying particular regions on the surface of a section. This procedure is connected to choose metal surfaces of carbon and amalgam steels, cast and flexible irons and some stainless steels, trailed by a suitable extinguishing strategy.

Table1: Composition of 316L stainless steel

C	Mn	Si	P	S	Cr	Mo	Ni	N
0.3	2.0	0.75	0.045	0.03	16-18	2-3	10-14	0.10

The rod sort 316 L review stainless steel were cut into little bits of length 30mm, width 8 mm, with the assistance of wire cut EDM process. A disc of 316 L material is utilized, with 165mm measurement and 8mm thickness. The pin material were subjected to flame hardening process and the disc material was surface hardened as far as possible.

2.1Process parameters:

Experiments were conducted on pin disc machine and the following parameters were varied. The load was applied by keeping the speed of rotation, sliding distance, sliding velocity and the time constant for one set of readings.

2.2 Wear Test:

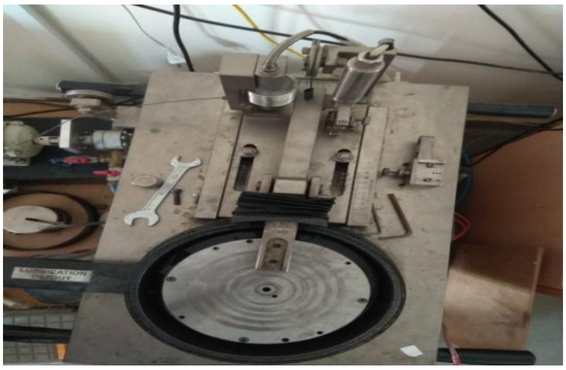

Fig.1: Pin on Disc Apparatus

The heaviness of the pins, both warmth treated and untreated are measured. At that point the pin is braced in the help. Before that the disc was settled in the rotor which is combined with engine by means of belt drive pulley. At that point the heap is connected against the pin upheld bar.

The pin on disc apparatus has a PC based controller, used to control the parameters of the pin on disc contraption. The parameters required are speed in rpm and load in Kg. In light of the parameters the framework will create the estimations of coefficient of grinding and estimations of frictional power for the given day and age in the interim of 5 minutes.

III. Optical Microscope Results:

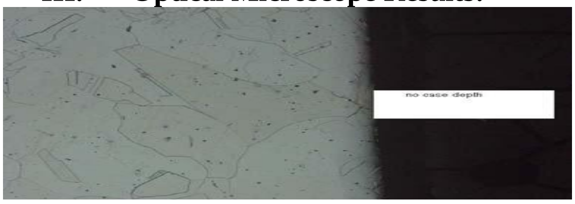

Fig.2: Case depth for untreated specimen

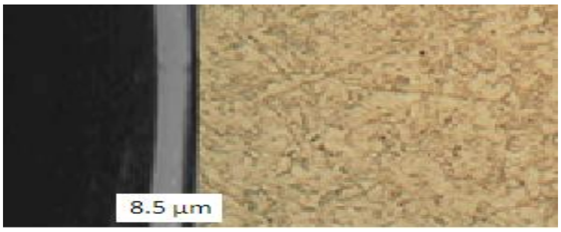

Fig 3: Flame Hardening for 1 min

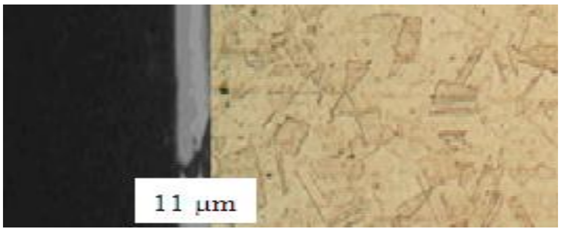

Fig 4: Flame Hardening for 3 min

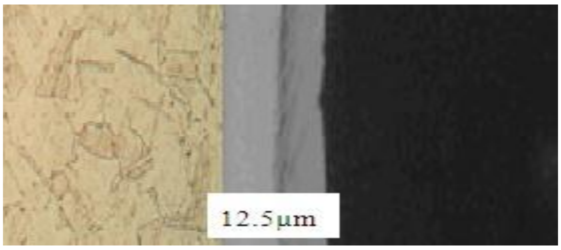

Fig5: Flame Hardening for5 min

From the above optical microscope results, it is noted that as the time of heat treatment increases, case depth also increases. It was noted that in an untreated specimen, no case depth was found. . In flame hardening specimen the case depth was found to be 8.5, 11, 12.5 µm respectively.

3.1 Hardness Results:

Rockwell hardness measurements were made to assess the influence of the heat treated specimens. The micro hardness at the surface of all specimens was measured. The hardness tests were performed under an indentation load of 100 grams for 15 seconds.

S.No	Specimen & Hardness Value
1	Untreated specimen - 72 HRC
2	FH1 – 76 HRC
3	FH 2 – 79 HRC
4	FH3 – 86 HRC

IV. Conclusion

In this work, flame hardening on 316L grade stainless steels was performed and the wear behaviour was studied. Here a comparison study was made between treated specimens with untreated sample. Flame hardening is viable technique to enhance the wear resistance of the stainless steel material. Several researchers investigated the effect of case hardening on mechanical and surface behaviour of carbon steels. Only little information is available on the wear behaviour of AISI 316L grade austenitic stainless steel material over flame hardening process.

As the time for treatment increases the case depth also increases. In Flame hardening process it was found to be 8.5, 11, 12.5 Microns which was treated to about 1, 3 and 5 minutes respectively.

From the wear studies we can find that FH3 specimen has a very good wear resistance when compared to other treated samples.

The combination action of strong adhesion, abrasion and severe plastic deformation are the primary reasons for the continuous material loss in the untreated specimens. Whereas the wear on the heat treated specimen in mild form is dominated by oxidation wear resistance and micro abrasion.

The results of this work have to be confirmed by other metallographic tests like Scanning electron microscope and EDAX results.

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