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Wear Conduct Examination of AISI 410 SS by Vacuum Tempering Process

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Abstract: *Martensitic stainless steels find broad applications because of their ideal blend of quality, hardness and wear resistance in tempered condition. AISI 410 martensitic stainless steel, subjected to vacuum treating was considered utilizing pin on disc tests took after by metallurgical examinations utilizing checking electron magnifying instrument and vitality dispersive spectroscopy. The microstructure comprises of tempered martensite with haphazardly dispersed carbides in the framework. In this paper, it is utilized to enhance the wear conduct investigation of martensitic stainless steel 410.*
Keywords: *AISI 410, Martensitic stainless steel, Metallographic test, Vacuum tempering*

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.

Martensitic stainless steels can be high or low carbon steels worked around the sort 410 creation of iron, 12% chromium and up to 1.2% carbon. They are generally tempered and solidified. Tempered martensite gives steel great hardness and high strength. Untempered martensite is low in durability and along these lines fragile.

To accomplish the coveted smaller scale structure and mechanical properties, martensitic stainless steel is subjected to a suitable hardening heat treatment. Be that as it may, for a given length of treating, a consistent diminishing in hardness with increment in hardening temperature frequently does not occur because of complex nature of the treating conduct. Rather, in certain amalgam steels optional solidifying is seen amid the hardening heat treatment.

This was a precise report on the hardening conduct and wear conduct investigation of AISI 410 SS with a goal of recognizing a reasonable warmth treatment keeping in mind the end goal to accomplish wanted properties without the danger of breaking amid warm treatment and consequent administration. This paper introduces the consequences of this investigation of wear conduct examination of AISI 410 SS by vacuum hardening heat treatment.

II. Experimental Details:

Table1: Composition of 410 stainless steel

C	Mn	Si	P	S	Ni	Cr
0.15	1	1	0.04	0.03	075	11.5

Since it is a near report on the impacts of vacuum hardening heat treatment, two examples were set up for every one of the tests. At first both the examples were subjected to solidifying at 900ºC. Toward the finish of solidifying process, both the examples were subjected to cryogenic treatment at - 100ºC. Toward the finish of cryogenic treatment, the examples were isolated into two clusters, of which one example was subjected to vacuum hardening at 500ºC and the other example was subjected to vacuum hardening at 600ºC for 3 hours. A vacuum furnace appeared in Fig 1 at PMTLee vacuum technologies was utilized for heat treating the stainless steel tests.

Fig.1: Vacuum Furnace

For miniaturized scale auxiliary perceptions, examples were set up with standard metallographic systems and scratched with kalings reagent. These examples were inspected under filtering electron magnifying instrument to discover variety in microstructure with vacuum hardening treatment.

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 2: 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. Results and Discussions:

3.1 Optical Microscope Results:

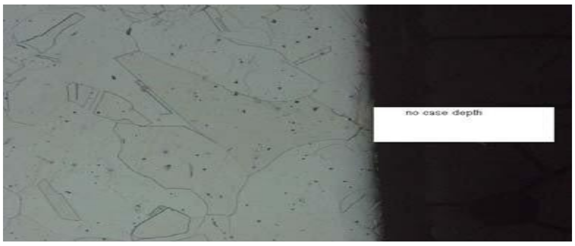

Fig.3: Case depth for untreated specimen

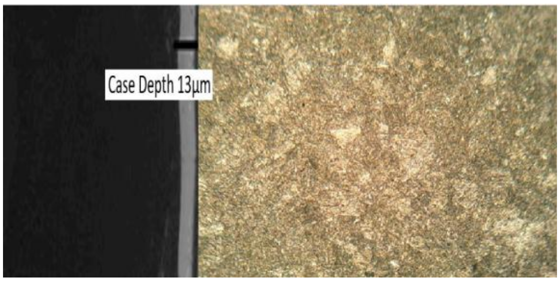

Fig 4: Vacuum tempering specimen (500ºC)

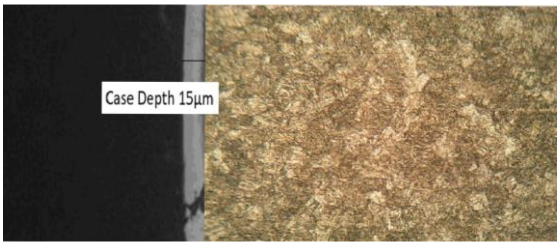

Fig 5: Vacuum tempering specimen (600ºC)

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 vacuum tempering specimens, the case depth was found to be 13, 15 µm respectively.

3.2 Scanning Electron Microscope Results:

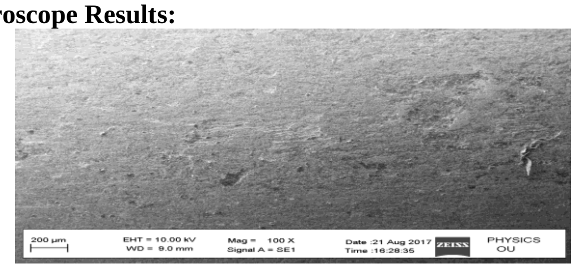

Fig 6: Vacuum tempering specimen (500ºC) at 100X

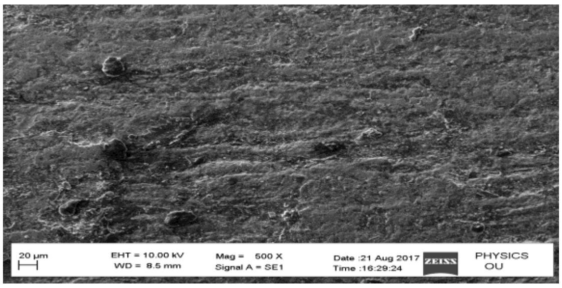

Fig 7: Vacuum tempering specimen (500ºC) at 500X

3.3 Pin on disc wear test:

Speed = 500rpm
Load = 10N
Time = 5minutes
Sliding velocity = 4m/s
Density = 7800 kg/m^3 = 0.0078 g/mm^3
Wear loss = Wt. before testing – Wt. after testing
Volume wear loss = Wear loss / Density
Specific wear rate = (Wear loss) / (Sliding distance*Density*Load)

Specimen	Wt before test (gms)	Wt after test (gms)	Wear loss (gms)	Volume wear loss (mm^3)	Specific wear rate (mm^3/Nm)
Untreated	9.98580	9.98538	0.00042	0.0538	0.5384
Vacuum tempering (500ºC)	11.68774	11.68580	0.00194	0.2487	0.6218
Vacuum tempering (600ºC)	9.98032	9.97648	0.00384	0.4923	0.9846

IV. Conclusion

The present research work indicates that AISI 410 SS, which has moderate toughness and high hardness in normalized condition, suffers embrittlement, with 773-848K being the tempering temperature range of maximum embrittlement. Results showed that types of carbides precipitated during different temperatures of tempering vary and iron rich Fe2C type of carbides are present in the temperature range where susceptibility to embrittlement is maximum.

The conclusions drawn from the various experimental results shows that the effect of applied load as well as the temperature on the wear behaviour of 410 stainless steel has been summarized. The role of reinforced amount as well as particle size of the reinforced rutile particle composites on the morphology, hardness and wear behaviour of composites has been concluded in this chapter. The scope of the further work is also given towards the end of this chapter.

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

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