Three Body Abrasive Wear Behavior of Hardfaced Low Carbon Steel

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Abstract— Traditionally Steel alloys have a reputation of being used in the applications where the emphasis is more on resistance of wear, strength, as well as stiffness than the reduction of weight. Alloys of steel are widely used in construction to automobile, to domestic applications. Steel alloy possess a wide range of properties say from corrosion resistance of wear to higher tensile toughness. The above mentioned properties can be a result of a alloying materials used the carbon percentage, included in materials and heat treatment is done. In construction industry additional element can be coupled to the iron and carbon based building materials we can strengthen it so that it can with stand more. The corrosive proof, nonmagnetic proof nonmagnetic steel gear with higher quality are used in military air craft's. The classification of steel plays an important rule to enable use to understand what type of steels are used in which kind of application. The common steels are mostly classified into three of the groups plain carbon, low alloy, high alloy. These classifications are set up and updated.

Key words: Al-Mg Amalgams, Cryotreated, ASTM G-65

I. INTRODUCTION

Low carbon steels are often referred as mild steels have carbon content lesser than 0.30% with grades with (AISI10xx). They are very in machining as well as welding for higher ductile nature compare to high carbon steels., their carbon content lesser than 0.25% is preferred when these types of steels are designed for welded applications. Typical steel alloys include molybdenum, nickel, chromium, silicon and manganese, which strengthen the alloy at room temperatures as well as increase toughness of low-temperature notch. When these alloys in the right combination, they known to improve resistance of corrosion, resistance of a wear and i steel response to heat treatment.

Low carbon steels have two yield-point when metals starts plastic deformation. One is upper yield-point (likewise called 1st yield-point) and lower yield-point(also called 2nd yield-point) run out where the material has two yield focuses. The principal yield point (or upper yield point) is higher than the second and the yield drops drastically after the upper yield point. If low carbon steel is simply engaged to some point between the upper and lower yield point then the surface may make Luder bands(A Lauder band is a limited band of plastic twisting which happens in specific materials before break. Those are surely understood in low carbon steels and some Al-Mg Amalgams.

The explanation behind their specter is the sticking of separations by interstitial (in steel, those are ordinarily carbon and nitrogen). This prompts low wear resistance, low quality and low erosion resistance. In especially, wear resistance decreases because of decreased in hardness of material. There are various meanings of wear and most take the type of 'the procedure of losing material from two surfaces that has been rubbed against each other'. Relative movement between machine part surfaces inexorably prompts an adjustment in these surfaces and in all probability some type of material loss of no less than one of the surfaces.

Maybe the greatest test in taking care of wear issue is that of foreseeing the type(s) of wear to which parts will be subjected. Material can be expelled from a strong surface in just three routes: by dissolving, by synthetic disintegration, or by the physical division of particles from the surface. The last system can be fulfilled either by the one-time utilization of a high strain or by cyclic straining at lower sizes. Mechanical and substance procedures may work independently or together, for example, scraped spot in a destructive medium.

The terms utilized as a part of the accompanying report is depict wear differ in light of the scientist's experience. Numerous terms are subjective to some degree. Case in point, one can frequently allude to a sliding domain as "grating(abrasive)" when it feels dirty substances on or close to the wearing surface. Actually, the wearing materials might not have been abrasively worn by any stretch of the imagination, but rather by some different procedure, for example, by the compound activity of the earth.

The grating(abrasive) wearing resistance is, when all is said in done, give or take relative to the hardness of the milder material. A few procedures have been created throughout the years to build the grating wear resistance of gear. Case in point, alumina pottery are utilized as surface covering on base metals to diminish the rough wear. In any case, these methods are costlier and typical individuals will be unable to get these offices. Subsequently, there is a need being developed of new strategy which decreases the wear rate of mating segments. Thus, it lessens the expense of gear material and time. Weld store is the regular and efficient method for expanding the wear resistance. This strategy is known as Hardfacing.

II. LITERATURE SURVEY

[1] Buchely J C et. al.: ; The influence of soil type & soil water on the wear of soil tillage tools reveals that, the soil water had a positive effect for loam and clay soils because the wear rate decreases as the water content increases. As the thickness of the cutting edge of the plough increased considerably, while rate of work & depth of tillage decreases.

[2] John J.Coronadoet. al:- The type of material used for plough tools, which also assists in reducing the catastrophic failure or break down of tool.It means that the material used for plough tool should have impact strength or impact resistance.Use of highly resistant materials coated on the soft substrate or base materials could

increase the hardness of the materials and yet retain the softer core to help impacts.

[3] Sanjay Kumar. et .al :- It was reported that volume wear of material rapidly decreases when the ratio of its hardness to that of the abrasive, exceeds about 0.8 at which point deterioration of abrasive commences.

[4] R. Choteborsky. et. al:- "The wear rate is proportional to the real contact area determined by the hardness of the softer material & the load". The abrasive wear resistance is in general approximately proportional to the hardness of the softer material.

III. PRESENT INVESTIGATION

The fundamental point of this study is to uncover the thoughts in the field of wear portrayal of Ordinary(normal), Cryotreated and Cryotreated with treating and Hardfacing alloys samples .The Hardfacing store and substrate materials are the principle parameters of interest, inborn and extraneous parameters were utilized amid the grating wear tests. Orderly wear examination of Hardfacing kept substrate is trailed by an examination of the ragged surfaces of Cryotreated, tempered and Hardfacing saved structure.

A. Preparing the Specimen:

Low carbon steel of 10 x 25 mm has taken for substrate material and separated that plate into obliged size according to ASTM G-65 standard of three body grating wear testing apparatus (Ducom). The cut example then machined utilizing forming machine, face crushing machine and surface granulating machine to set craved levelness and surface consistency, buffing has done utilizing plume wheel buffing machine lastly cleaned on velvet fabric utilizing acetylene to get mirror complete .The example estimate 75x25x12.7mm according to ASTM G-65 standard.

B. Cryogenic Treatment:

Cryogenic treatment is utilized for 1-hour by totally plunghing into fluid nitrogen. Following one hour examples are expelled from the fluid nitrogen holder and kept couple of minutes to accomplish room temperature. Temperatures, underneath -196°C, will significantly build the quality and wear life of a wide range of vehicle segments, castings and cutting devices.4.2(a) Liquid nitrozen container4.2(b) Cryoterated specimens

Fig. 1:

C. Tempering After Cryogenic Treatment:

Steels are tempered by warming in the wake of solidifying to get particular estimations of mechanical properties furthermore to mitigate extinguishing anxieties and to guarantee dimensional steadiness. Treating is done after Cryogenic Treatment for 1-Hour at 270 °C in the Electrical Heater. The tempered examples are expelled from heater following 1- hour and air cooling is done to accomplish room temperature. Exploratory set up of electrical heater as indicated.

D. Hardfacing:

Hardfacing can be utilized by covering strategy, welding method relying upon obliged applications. In the present work Hardfacing is finished by Manual Circular segment Welding (Throat).

ZEDALLOY VB anode of 4mm breadth and 400mm length is utilized for Hardfacing testimony on substrate material to expand surface hardness. By the proposal reverse welding organization 140-180 air conditioner, DC (+) current is utilized to stay away from over warming or dissolving of base material to get required surface hardness.

Element	C	SiCMn	S	Pb	Cr	Fe	
In %	2.2-2.8	2.5-3.5	0.80-1.25	0.03 max	0.03 max	3-4	Balanced

Table 1: Shows the Chemical Composition Hardfacing electrode ZEDALLOY VB

Fig. 2: Specimens Are Fixed On Iron Strip

IV. TESTING

A. Schematic Diagram of Dry Sand/Rubber Wheel Abrasive Wear Test Rig:

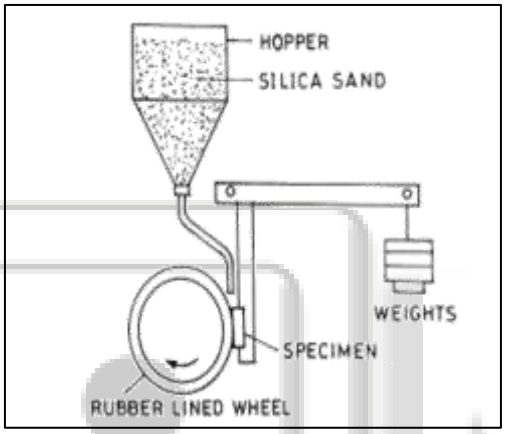

Fig. 3:

Three body abrasive wear test is completed according to ASTM G 65, Standard test strategy for measuring scraped spot utilizing the dry sand/elastic wheel test apparatus. Schematic graph of dry sand/elastic wheel grating wear test apparatus as indicated in Fig. The rough is presented between the test example and a pivoting wheel with a chlorobutyl elastic tire towards the sand stream.

$$HBS \text{ or } HBW = 0.102\,[m]P5\frac{2F}{\pi D(D-\sqrt{D^2-d^2})}$$

Material	Brinell Hardness number (HBS or HBW)
Normal Sample	160
After cryogenic treatment	218
After cryogenic treatment with tempering	260
Hardfaced deposited sample	646

Table 2: Hardness of Materials

This test example is squeezed against the turning wheel at a predefined drive by method for a lever arm while a controlled stream of coarseness rubs the test surface. The pivot of the wheel is such that its contact face moves

Levels	Load applied in N	Velocity of sliding in m/s	Speed of sliding in rpm	Sliding distance (m)	time in min
1	5	0.3590	30	100	1.5470
2	10	0.7181	60	200	3.0900
3	15	1.050	90	300	5.0410

Table 3: Process Parameters with Value

V. RESULTS AND DISCUSSION

A. Effect Applied:

1) Load:

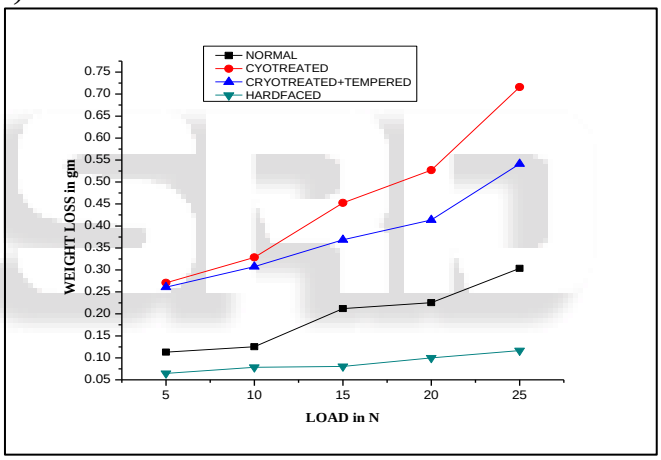

FIG 4: (A) Gragh Shows Weight Loss in Grams V/S Load in Newtons

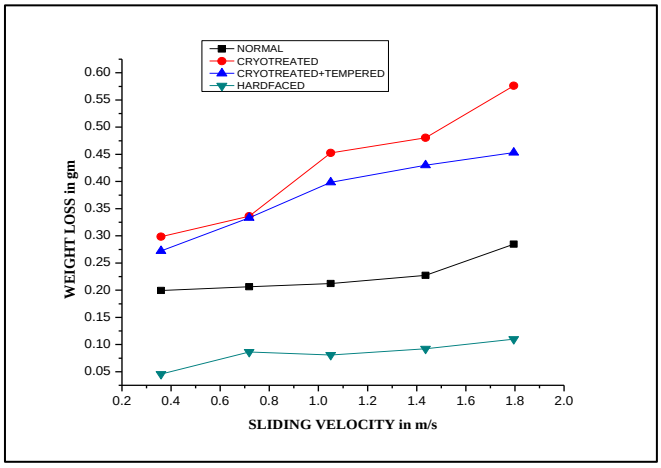

Fig. 5: (B) Graph of Weight Loss in Grams to Sliding Velocity in M/S

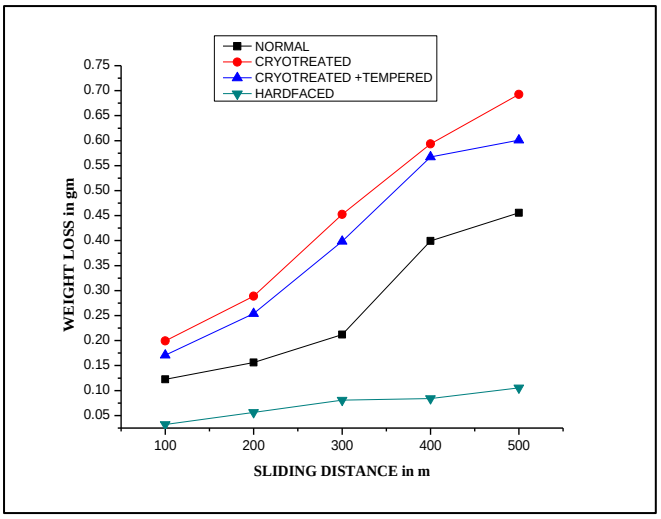

Fig. 6: (C) Graph of Weight Loss in Grams to Sliding Distance in M

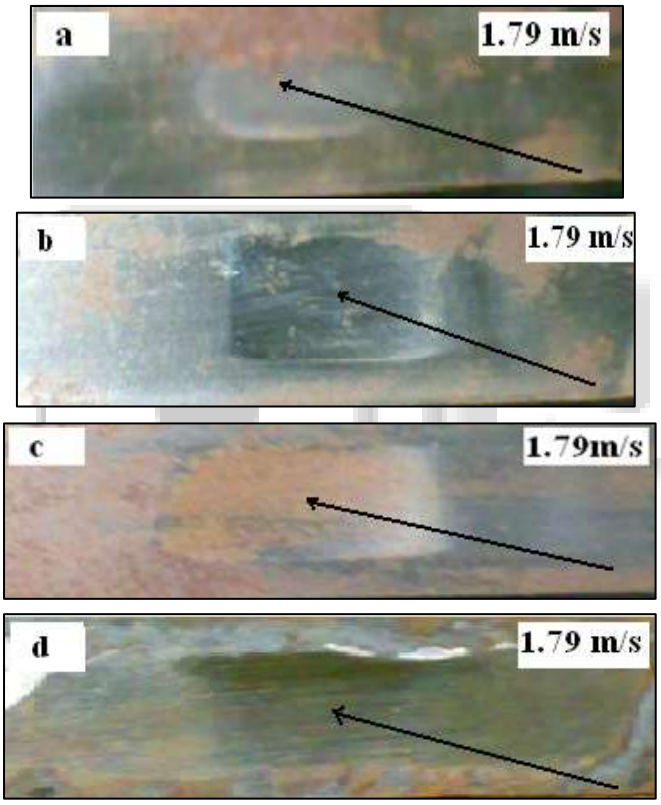

Fig. 7: Shows variation of wear weight loss against Sliding Velocity 1.79 m/s at a constantApplied Load 25and at Sliding Distance 300 m (a) Normal (b) Cryotreated (c) Cryotreated tempering (d) Hardfaced

In the present examination to enhance the wear resistance distinctive strategy are taken after viz, The Profound Cryotreatment Treatment is completed for 1 h in Fluid Nitrogen (LN2), Cryotreated with Treating is done after the Cryogenic Treatment for around 1 h at 270 °C in the Electrical Heater and Hardfaced combination.

VI. CONCLUSIONS

1) The Hardfacingby Welding (Arc welding) is an alternative method of reducing wear.
2) It can be proposed that the Hardfacing austenitic steels happened by circular segment welding is helpful for nearby repair, support, recoating utilizations of gentle steel surfaces to disintegration, Paying little heed to multilayer coatings.
3) In general terms, no connection was found in the middle of hardness and the grating wear Resistance. This is because of the way that the carbides and network microstructure.
4) The nature of material removalis microploughing or microcutting depending on the attack angle, due to cracks formed on the surface of material.
5) Cryogenic treatment alone can not provide good abrasive wear resistance tools, hence heat Treatment like quenching, tempering should be done after Cryogenic treatment.

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