HARDFACING LAYER ON MILD STEEL

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Abstract— Mild steel (MS) may be a soft metal having varied applications at intervals the sphere of engineering. steel is subjected to surface contact with totally different metals such in machine tool guide ways in which within which, dipper dozer teeth's with soil, nozzles to impact jets etc. 3 factorial vogue has been chosen by taking chromium proportion and current as parameters. Higher proportion of chromium and lower current provides higher hardness and having minimum wear rate it's been established that the applying of axial field increase weld breadth and reinforcement height and reduce weld penetration. This development has been accustomed advantage in onerous facing application because the weld penetration decrease heat dilution of weld metal within the base metal decrease. At so the hardness can will increase unremarkably we have a tendency to deposit multilayers of weld metal to extend the hardness of weld deposit metal that result's reduced dilution of weld metal.

Keywords—Hardfacing, Wear, Mild steel, Hardness

I. Introduction

Surface improvement is finished by two ways that during which either by improvement of the surface characteristics or by victimization the big-ticket metals having elements like chromium. Hardfacing techniques more as advances in hardfacing conductor have given rise to surface coatings with superb wear resistant properties to a lower place severe service conditions, so enlarging the field of applications. during this bestowed thesis on wear study, the secure Metal Arc fastening (SMAW) methodology of creating surface modification to boost the wear and tear properties of low-carbon steel materials has been used. The low-carbon steel is hardfaced with completely different compositions of Cr. The low-carbon steel is usually used material because of its low price, that at same time soft material with poor wear properties. to cut back this wear downside, the hardfacing was done by fastening coating (fastening of metal and soluble glass) victimization SMAW on the low-carbon steel plate and were investigated with respect to their wear and microhardness characteristics. The deposition of overlay coatings, by fastening or thermal spraying techniques, is often utilized in business, either throughout maintenance or within the manufacture of latest elements [1,2], to boost the wear and tear resistant properties of surfaces in touch. one amongst the most vital factors touching abrasion resistance is that the microstructure of the material being injured .This will be connected to its hardness, that indicates a material's resistance to indentation, for example associate degree abrasive particle. Generally, the bigger the abrasive penetration the higher the wear rate [3]. It has been rated that associate degree optimum hardness/microstructural condition exists that provides the highest wear resistance. This was achieved at low temperatures [4].The deposition of emergence layers by fastening techniques, like protect manual arc fastening (SMAW), submerged arc fastening (SAW), plasma arc fastening (PAW), oxyacetylene fastening etc. have been wide applied commercially in an exceedingly big selection of industries so as to boost the wear and tear and corrosion resistance of the elements [4-8].

II. Materials and Methods

The style matrix developed to conduct the 9 trials runs of 3^2 factorial design. Beads on the low-carbon steel plates are deposited as per the look matrix with the SMAW E-7014 conductor.

2.1 *SELECTION OF BASE METAL*

Mild steel was designated as base material for hardfacing purpose, as we all know that it's chiefly utilized in wide application within the fabrication trade. low-carbon steel is low steel having low wear resistance and low hardness. because of low hardness it will

not have the damage resistance therefore low-carbon steel has been chosen for the study. Surface characteristics like wear will be increased by applying totally different surface techniques. Hardfacing is a deposition of metal over a substrate metal for that delicate steel has been harfaced when paste coating of atomic number 24 powder that was mixed with binder named glass.

2.2 *SELECTION OF METAL POWDERS*

One hardfacing powder was selected . This hardfacing powder is mixed in water glass and coating is applied within the kind of paste. This hardfacing powder was mixed in several proportions in water glass to organize pastes, that was applied on to the surface to be hardfaced within the kind of coating. atomic number 24 powder and water glass were used. 3 sets of specimens are created on that atomic number 24 powder was applied. Custom die had been created for the aim to support the specimen throughout paste coating technique.

Fig 1: Mild Steel Plates

2.3 PROCESS PARAMETERS AND THEIR LEVELS FOR EXPERIMENTATION

The process parameters affecting wear have been identified to enable the carrying out the experimental work and the development of mathematical models. They are welding current (C), chromium percentage (Cr %).The upper limit of a factor is coded as (H) and lower limit as (L) or intermediate limit as (I). The decided values of process parameters with their units and notations are given in

2.4 DEVELOPMENT OF style MATRIX

The style matrix developed to conduct the 9 trials of 3^2 (=9) 3 level factorial design. wherever H denotes higher level, I denote intermediate level, L denotes lower level.

2.5 PREPARATION OF BASE MATERIAL

Three gentle steel plates (200×30×10) millimeter has been selected . The gentle steel specimen were taken as the base metal or substrate material upon that the laborious facing material was deposited by SMAW fastening when the applying of paste.

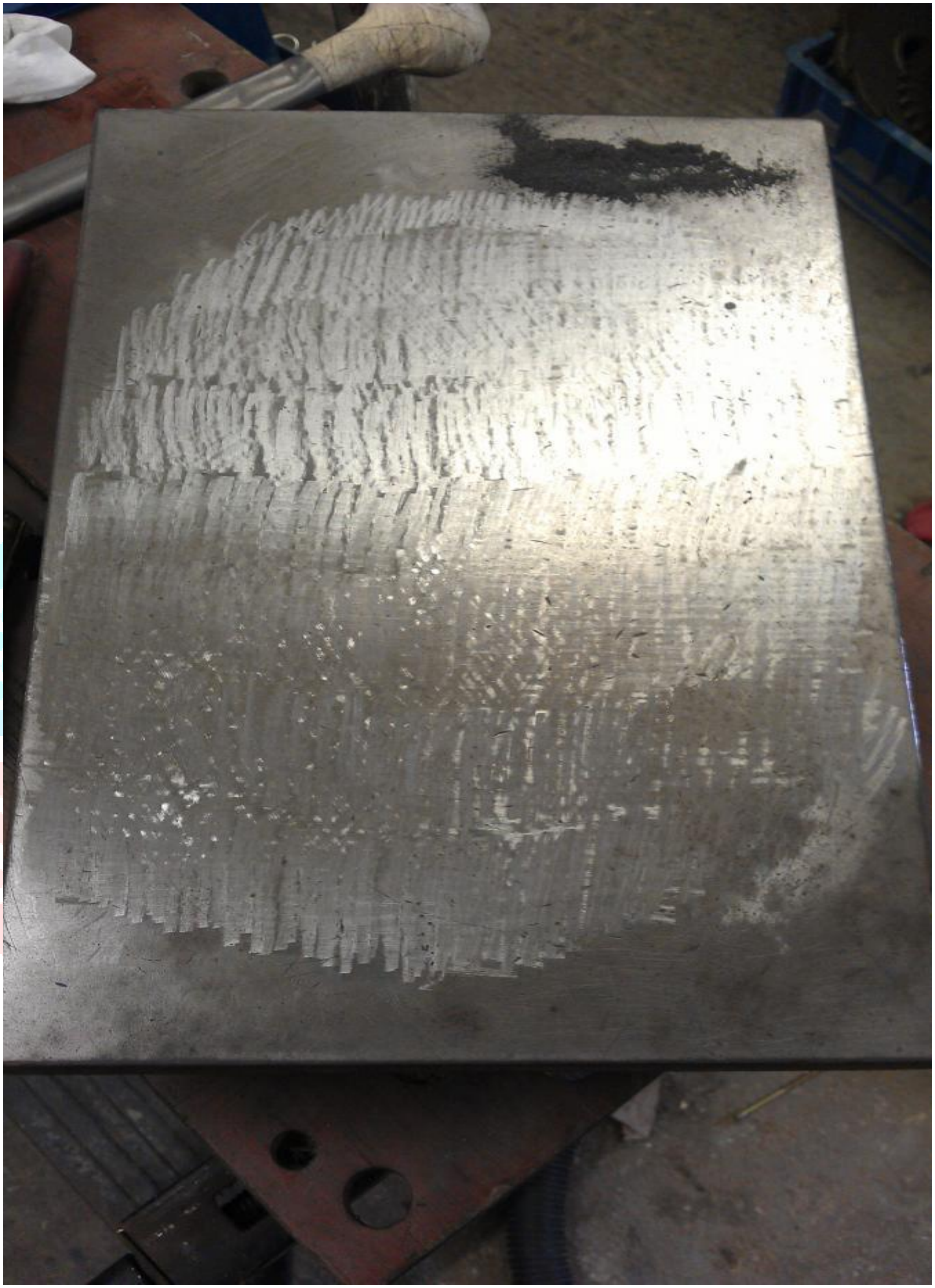

Fig.2 coated mild steel plate

As per the info generated by the trial runs the particular experiments were conducted by giving birth down the beads of various powders paste. To develop Cr inorganic compound primarily based hardfacing alloy a paste was created with the mixture of Cr and a binder (sodium silicate), coated on a light plate with the assistance of custom created die. Depositions were created with completely different formulations Total nine samples with three classes were investigated..

TABLE 2: DESIGN MATRIX, WHERE H DENOTES HIGHER LEVEL, I DENOTE INTERMEDIATE LEVEL, AND L DENOTES LOWER LEVEL

Sr. No.	**Sample name**	**Cr %**	**Current**
1	HH	H	H
2.	HI	H	I
3.	HL	H	L
4.	IH	I	H
5.	II	I	I
6.	IL	I	L
7.	LH	L	H
8.	LI	L	I
9.	LL	L	L

2.6 Micro hardness check

Micro hardness measuring was disbursed at Institute for automotive vehicle components & Hand Tools Technology, Ludhiana victimization small hardness tester on VHN (Vickers Hardness Number) Scale.

2.7 Wear check

Wear check was carried out on wear check machine at science Laboratory of applied science department, LPU, Phagwara. The wheel rotation was a thousand rev. 3 reading were taken to search out out the common worth. The sample weight was checked once five minute. Final loss in weight was measured of the samples; loss in weight are often correlative to point the damage rate of every sample.

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III. Result and Discussions

3.1 Micro hardness

All the 10 samples were initial polished on disc sharpening machine and at that time the small hardness was checked. The small hardness was checked on middle position. At each sample one reading was taken.Hardness readings area unit shown in Table three small hardness of base metal is 208 VHN.

TABLE 3 MICRO HARDNESS RESULT (ALL SAMPLES)

Sample no.	Sample name	Harness in VHN
1.	HH	637
2.	HI	587
3.	HL	557
4.	IH	615
5.	II	589
6.	IL	562
7.	LH	365
8.	LI	321
9.	LL	282
10.	BASE METAL	2

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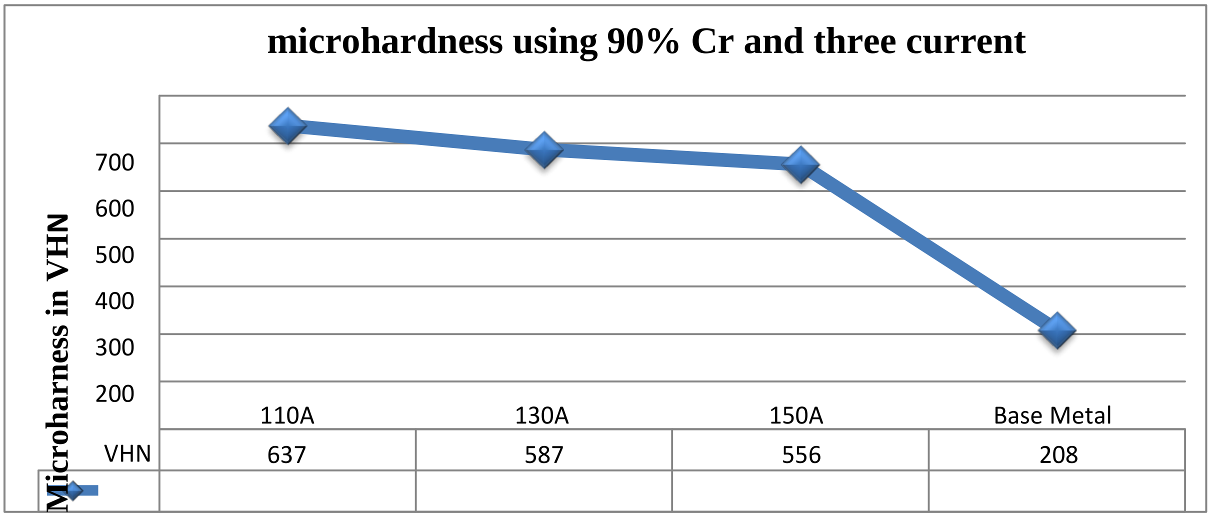

Fig. 4 **Line graph comparison of micro hardness of 90% Cr using three current**

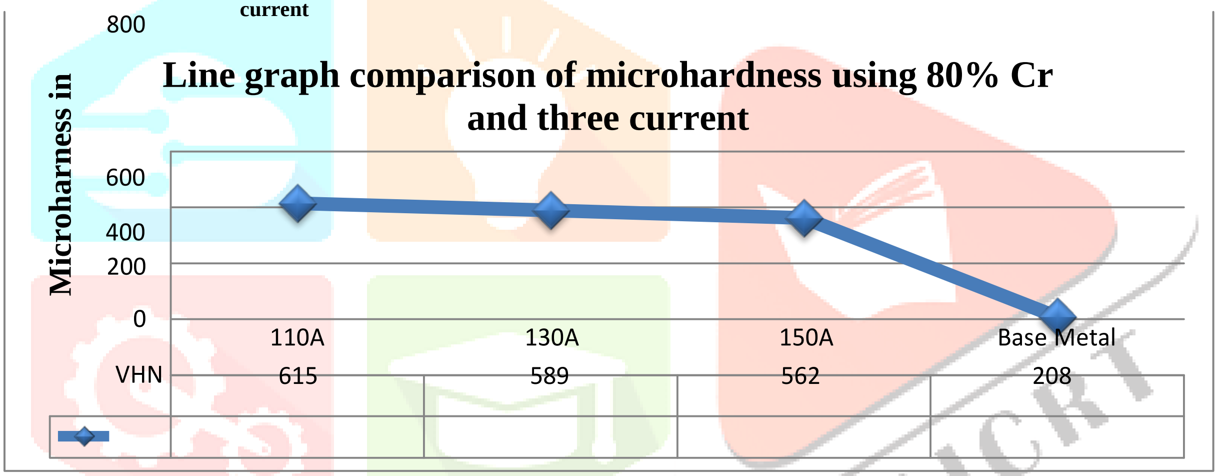

Fig. 5 **Line graph comparison of micro hardness of 80% Cr using three current**

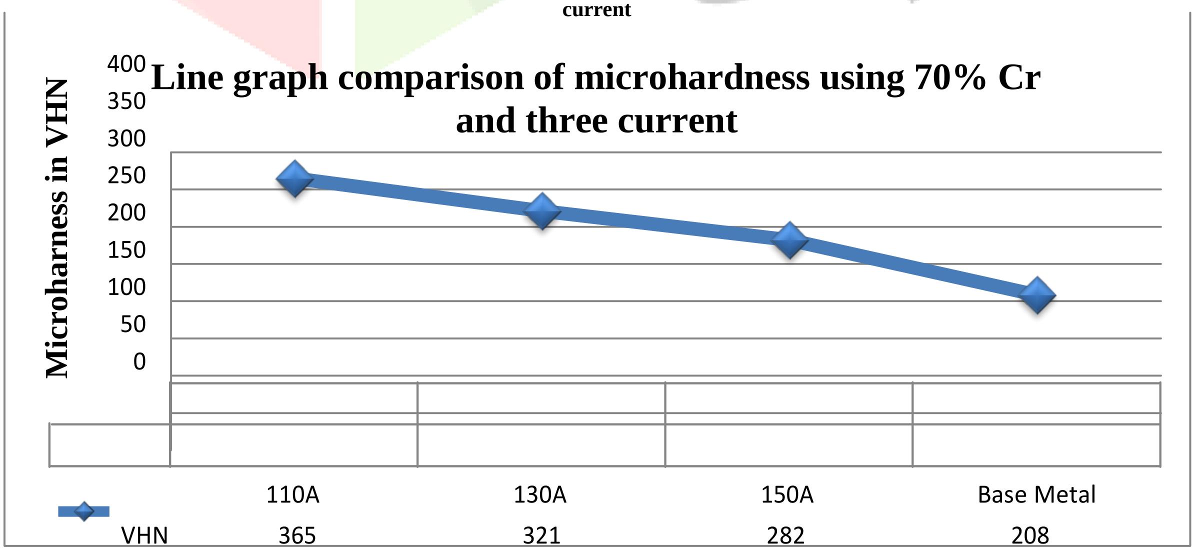

Fig. 6 **Line graph comparison of microhardness of 70% Cr using three current**

From the on top of observation it are often simply ended that at 110A current the micohardness is coming back higher as compared to micohardness values at 130A an150 A. the most reason is that with the rise of current hardness decrease for all the 3 compositions of the paste thanks to reason that prime current leads to slower cooling rates leading to softer matrix having lower hardness. Higher the cooling rate can turn out higher micohardness . it's been conjointly ascertained that the hardness values are often increased by or so three.10 times victimisation ninetieth atomic number 24, 3.04 times by victimisation eightieth atomic number 24 and one.88 times by victimization seventieth atomic number 24 Powder, thanks to the explanation that higher quantity of metallic element leads to inflated inorganic compound formation.

3.2 Wear Test

Wear rate was calculated by measuring initial and final weights of samples. Loss in weight was calculated for the running wear period of 5 min. Then the wear rate was calculated per hour i.e for 60 min from loss of weight for 5 min.

TABLE 5. WEAR RATE READINGS OF ALL SAMPLES

Sample no.	Name	Initial Weight(g)	Loss Weight(g)	Final Weight(g)	Wear rate (g/hr.)
1	HH	5.6896	0.0051	5.6845	0.0612
2	HI	5.6825	0.0039	5.6786	0.0468
3	HL	5.6876	0.0021	5.6855	0.0252
4	IH	5.5934	0.0051	5.6845	0.0924
5	II	5.6382	0.0049	5.6333	0.0588
6	IL	5.801	0.0046	5.7964	0.0552
7	LH	5.589	0.0108	5.5782	0.1296
8	LI	5.6341	0.0089	5.6252	0.1068
9	LL	5.6559	0.0081	5.6528	0.0972
10	BASE METAL	5.5611	0.134	5.4271	1.608

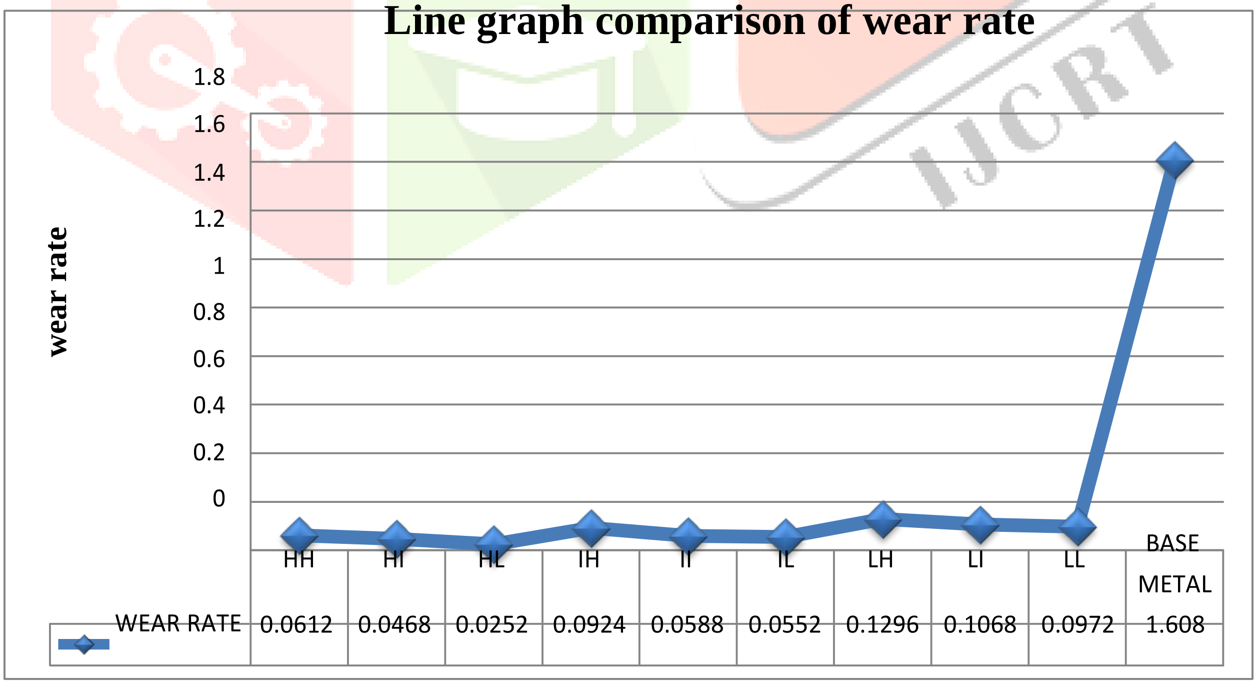

Fig. 10 **Line graph comparison of wear rate for all samples**

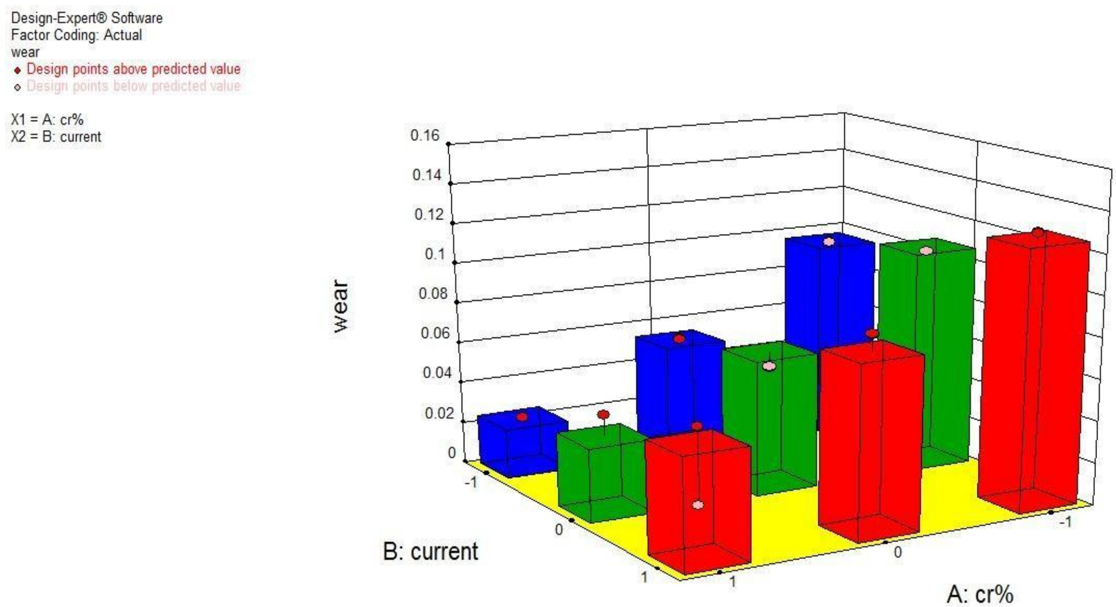

Fig .11 **Combined Interaction of process parameters (3 dimensional views)**

Fig .11 shows the combined impact of method parameters on wear. it's been determined that because the current is increasing the wear and tear rate conjointly increasing due to decreasing hardness and once artistic is increasing the wear rate decreasing because of higher formation of carbides. an equivalent observations are detected all told the 3 compositions of paste.

IV.CONCLUSIONS

The hardness values is increased by some three.10 times exploitation ninetieth metal, 3.04 times by exploitation eightieth metal and one.88 times by exploitation seventieth metal Powder. Wear resistance is increased up to twenty six times exploitation ninetieth metal, seventeen times exploitation eightieth metal and twelve times by exploitation seventieth metal than base metal (mild steel).Considering all the aspects it's going to be terminated that paste with ninetieth metal offers higher wear properties and micro-hardness as compared to stick with eightieth and &70% metal content.

It has been additionally ascertained that dilution increasing once fastening current increasing. it's owing to the very fact that current density will increase with increase in fastening current as a result higher melting of conductor as a result of with a rise in fastening current there is a linear increase in arc heat whereas the resistance heat increase exponentially that square measure accountable for conductor melting ensuing increase the space of penetration therefore dilution. It has been ascertained that with the increase of current hardness decrease for all the 3 compositions of the paste owing to reason that prime current ends up in slower cooling rates leading to softer matrix having lower hardness.

The wear studies show that because the current is increasing the wear and tear rate additionally increasing owing to decreasing hardness. an equivalent observations are noticed altogether the 3 compositions of paste.

V.REFRENCES

1. Metals Handbook, vol. 6: Welding, Brazing and Soldering, 9th ed., American Society for Metals, Metals Park, Ohio, 1983, pp. 771–772.
2. J.F. Archard, Contact and rubbing of flat surfaces, J. Appl. Phys. 24(1960) 981
3. M. Martinez Gamba, J. Garc´ıa, H. Dall'O, J. Sikora, Comportamiento a la abrasión de ADI destinada a uso agr´ıcolas y mineros, in: Proceedings of the Jornadas Metalúrgicas, Sociedad Argentina de Metales (S.A.M.), Bah´ıa Blanca, Argentina, 1994, pp. 133–136.
4. K.C. Antony, K.J. Bhansali, R.W. Messler Jr., A.E. Miller, M.O. Price, R.C. Tuckeer Jr., Hardfacing Metals Handbook, vol. 6, ninth ed.,Welding, Brazing and Soldering, American Society for Metals, 1983, pp. 771–793.
5. A.E.Yaedu, A.S.C.M. D'Oliveira, Mater. Sci. Technol. 21 (2005) 459–466.
6. H. Kashani, A. Amadeh, H.M. Ghasemi, Wear 262 (2007) 800–806.
7. S.H. Choo, C.K. Kim, K. Euh, S. Lee, J.Y. Jung, S. Ahn, Metall. Mater. Trans. A: Phys. Metall. Mater. Sci. 31 (2000) 3041–3052.