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A Study on Metallurgical Evaluation of Stellite-6 Deposits on Low Alloy Steel 817m40t for High Temperature Applications

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ABSTRACT: Hard facing is a minimal effort strategy for saving wear safe surfaces on metal segments to expand administration life. Wear related disappointment of hardware parts considers one of the significant purposes behind wasteful working of machines in an assortment of designing applications. Scraped area is one of the significant and ordinarily watched wear modes in these cases. Wear opposition of materials can be improved through surface alteration procedures. The apparatus utilized in different businesses like development, farming, and moving factories is confronting wear issue. Wear is the overwhelming component that controls the life of any machine part. Most worn parts don't come up short from a solitary method of wear, however from a blend of modes, for example, scraped spot and disintegration and so forth and numerous examinations uncovered that carbon and chromium the significant component which are utilized in hard facing compounds In this paper upgrade of wear obstruction conduct of EN24 grade low alloy steels by use hard facing cathode stellite 6 and gas tungsten arc welding(GTAW)process utilized in hard facing improve the hardness base material and furthermore research the impact of welds structure on opposition against wear.

KEYWORDS: GTAW, EN24, etc.

I. INTRODUCTION

Hard confronting is commonly utilized for surfacing parts presented to mechanical wear, scraped spot, sway annoying, disintegration and cavitation. Segments in the field will be presented to erosion, high temperature scaling, sway, heat, metal to metal wear, scraped spot or a blend of these elements. The metals utilized for applications must have properties like wear opposition, consumption obstruction or temperature obstruction. Yet, metal with every one of those properties are profoundly costly. Rather than making the whole part from a profoundly costly metal which has all the obstruction properties it is affordable to fabricate the part from metal of ease and afterward spread the basic surfaces with a metal which has all the properties, for example, wear, erosion and temperature opposition.

The use of a covering of a compound to a metallic surface of a segment by the methods for welding or showering with the aim of expanding the working existence of the segment is called as hard facing. Hard – confronting is utilized to forestall or control different types of surface corruption, for example, metal to metal wear and additionally grating wear. Here we will talk about metal to metal and grating wear. Anyway it ought to be noticed that hard facing is additionally powerful in countering different types of wear, for example, sway stacking, disintegration and cavitation or thblend of these elements. One noted such blend is wear and erosion for instance slurry siphons, cuts in nourishment preparing industry, valves and so forth.



This are the below wear factors affected by the base material.

Types of wear:

TYPES OF WEAR

- Adhesivewear
- Abrasivewear
- Erosive wear

ADHESIVE WEAR:

Glue wear disappointment modes are scoring, irking, seizing, and scraping. They result when infinitesimal projections at the sliding interface between two mating parts weld together under high nearby weights and temperatures. Subsequent to welding together, sliding powers tear the metal from one surface. The outcome is brief depression on one surface and a projection on the other, which will bring about additional harm. In this manner, glue wear starts infinitesimally yet advances perceptibly.

ABRASIVE WEAR

Rough wear is commonly ordered by the contact condition and the kind of contact. The contact type characterizes the grating wear mode. When all is said in done, there are two kinds of rough wear: Two-body rough wear - This sort happens when hard particles or coarseness take out material from the restricting surface. This can be best depicted by thinking about a material being dislodged or evacuated through a furrowing or cutting activity. Three-body wear - This happens when the particles are unconstrained and can slide down and move on a surface. The earth of contact characterizes whether the order of wear is a shut or open sort. An open wear condition happens when surfaces are enough dislodged to turn out to be liberated from one another.

EROSIVE WEAR

Erosive wear can be characterized as an incredibly short sliding movement and is executed inside a brief timeframe span. Erosive wear is brought about by the effect of particles of strong or fluid against the outside of an article

II. EXPERIMENTAL PROCEDURE

Table-1 Composition Vs Mass percentage

Composition	C	Cr	Si	W	Fe	Mo	Ni	Mn	Co
Mass percentage	1.15	29	1.10	4	3	1	3	0.5	Bal

PREPARATION OF STELLITE 6 HARDFACING

EN 24 low composite steel was utilized as substrate, and Stellite 6 compounds were welded by plasma moved curve welding (PTAW). The sythesis (wt%) of EN 24 low amalgam steel was 0.35-0.44 C, 0.45-0.70 Mn, 0.10-0.35 Si, 1.30-1.70 Ni, 1.00-1.40 Cr, 0.20-0.35 Mo and adjusted Fe. The piece of Stellite 6 powder is recorded in Table 1. The outside of the grid was cleaned with CH₃)₂CO and washed with refined water to evacuate buildup and oil. A short time later, the grid was air- dried. The Stellite 6 powder was repainted on the outside of the substrate. The thickness of powder was around 5 to 6 mm. The covering was set up by the GTAW strategy with a current of 150A.

Microstructural Characterization

EN 24 low composite steel with covering was cut along the opposite heading of the reaching line of the substrate and covering. At that point, the cutting surface of the covering was encased with Bakelite. The outside of the examples was cleaned by SiC sandpaper down to 1,500#, trailed by cleaning cushion with alumina powder. At that point, the surface was washed with refined water and ultrasonicated in a water shower for 5 min. A short time later, the microstructure of the covering was scratched by nitrohydrochloric corrosive. The pictures of the covering when wear were taken by an optical magnifying lens and a filtering electron magnifying lens (SEM).

III. RESULTS

A. XRD ANALYSIS

XRD Analysis of Stellite 6 Alloys. The results of XRD analysis of Stellite 6 alloy coating are shown in Figure 1. The phases of deposited coating are α -Co and M₇C₆ (M = Fe, Cr), which are determined by comparison with the lattice parameter of standard JCPDS cards. The highest peak intensity is recorded for the α -Co and (Cr, Fe) γ C₃ phases, and the peaks of these two phases overlap. The presence of (Cr,Fe) γ C₃ [23] plays a key role in increasing the hardness of the coating

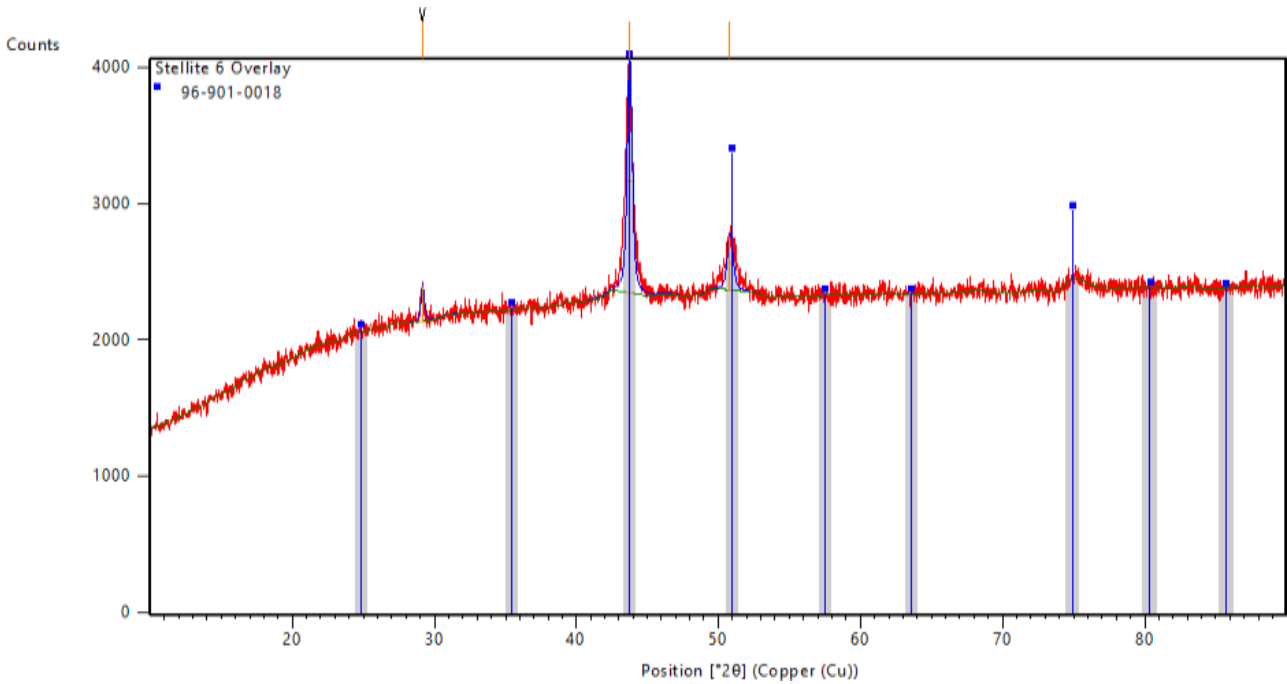


Fig 1-XRDAnalysis of Stellite 6 Alloys.

Table -2XRDAnalysis of Stellite 6 Alloys values

Pos. [°2θ]	Height[cts]	FWHM Left[°2θ]	d-spacing [Å]	Rel. Int. [%]
29.1497	253.12	0.2598	3.06359	15.40
43.7372	1643.77	0.3897	2.06974	100.00
50.7987	392.79	0.4330	1.79737	23.90

B. MICROSTRUCTURE EXAMINATION

Microstructure of Stellite 6 Alloy Hardfacing the microstructure of the covering from substrate to surface. By and large, the microstructure of welding covering is partitioned into three sections, to be specific, weakening, change, and fine grain zones [25]. Figure 2(a) shows the combination line among substrate and covering. The weakening zone of the covering is appeared as red square shapes in Figure 2(b). Planar crystalline structures were seen over the substrate. These planar crystalline structures interact with the grains of the substrate. New grains as a rule form from unmelted grain. The size of the new grains increments along the first course of the gem. At that point, columnar precious stone is shaped along the opposite bearing of the combination line, as appeared in Figure 2(c). As solidification proceeds, the upper part of the covering around the surface turns into the fine grain zone, as appeared in Figure 2(d). In the fine grain districts, the precious stone displays multidirectional development. The cell dendritic carbides are encompassed by the strong arrangement of Co and Cr, which sets toward the surface, as appeared in Figure 3. The microstructure of the covering is homogeneous. The dendritic carbides can assume a key job in expanding the hardness and wear opposition of the Scanning the pearlite 60% and ferrite 40% obtained by the hard facing microstructure.

Microstructure consists of ferrite and bainite Before heat treatment



Fig 2-Microstructure of Base Metal EN24

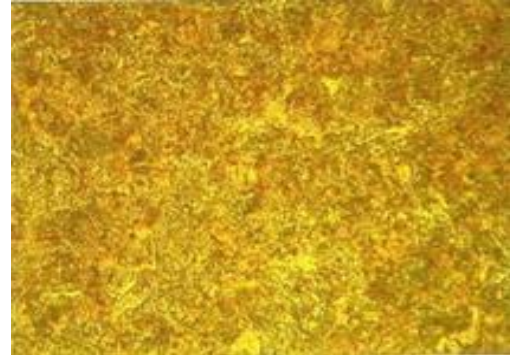


Fig 3-Microstructure of Base Metal EN24

After heat treatment
Microstructure consists of tempered martensite

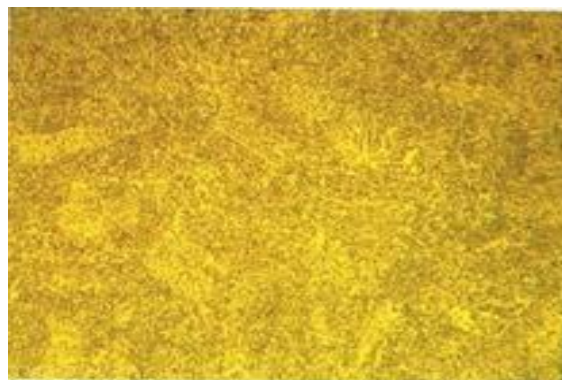


Fig 4 -Microstructure of Weld Metal EN 24

C. ROCKWELL HARDNESS

First, the indenter is squeezed with the test pre-power (additionally alluded to as pre- power or preload) to an infiltration profundity of h_0 in the example to be tried defines the reference level (reason) for consequent estimation of the remaining space profundity (h). Next, the extratest power is applied for a stay period characterized as per the standard (a few seconds), whereby the indenter infiltrates into the example to a greatest space profundity of h_1 . The test pre-power in addition to the extra test power gives the all-out test power (likewise alluded to as all out power or primary burden).



Table-3 Rockwell Hardness load and value

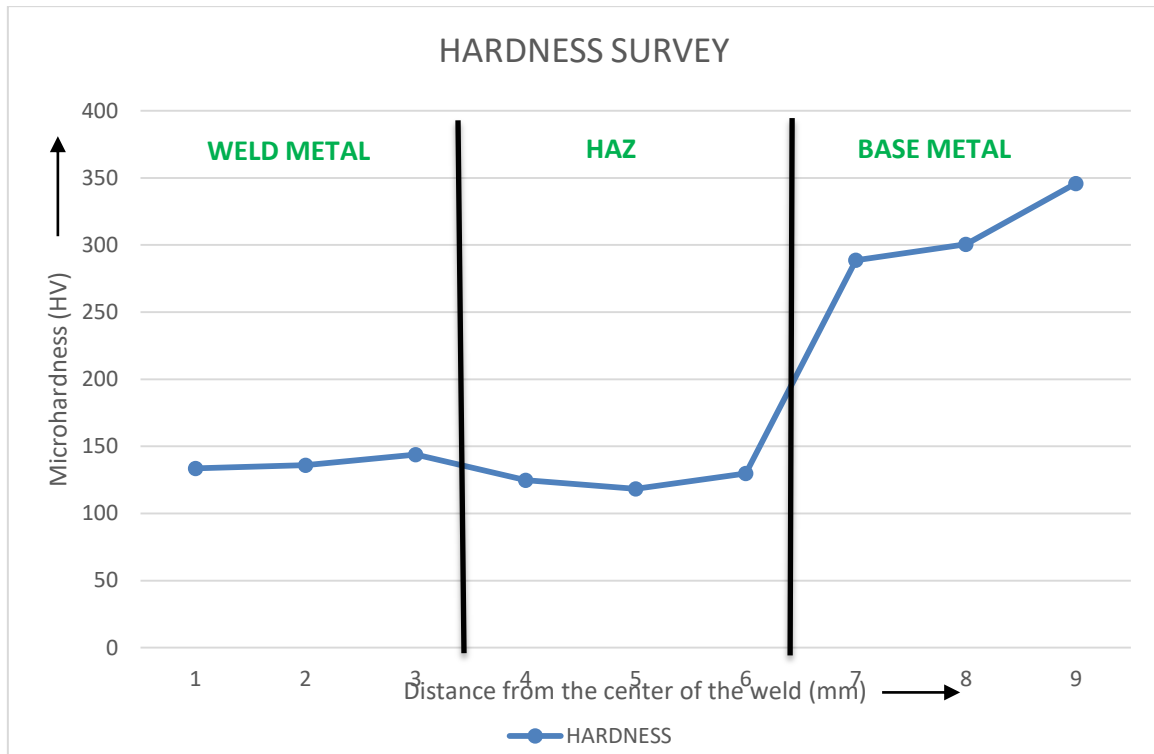
Load	Hardness value
150kgf	42
150kgf	45
150kgf	46

D. MICROHARDNESS.

The generalized "wear equation" confirms an intuitive fundamental precept in wear that wear resistance increases (wear volume decreases) as hardness increases. However, the manner by which material hardness is achieved is important in wear situations. The hardness of most of the Stellite alloys are derived from dispersions of hard carbides in somewhat softer solid solution matrix alloys. To a first approximation, however, the hardness of the Stellite alloys is dictated primarily by the carbon and/or combined carbon contents. Microhardness is a measure of the overlay's resistance to localized plastic deformation. It is strongly dependent on the dilution, microstructure and in particular on amount of carbides generated. Vickers microhardness was done with 300 g to determine micro hardness profile same in transverse cross sectional area both in low and high dilution parameters.

Table 4- Micro hardness value

REGION	HARDNESS VALUEHV
WELD METAL ZONE	133.5
	135.9
	143.8
HEATAFFECTED ZONE	124.7
	118.3
	129.8
BASE METAL ZONE	288.7
	300.5
	345.8



IV. CONCLUSION

1. For low alloy steels the weldability is poor, so it is necessary to do preheating and postweld heat treatment for welding to avoid the cracking tendency of the base material
2. By doing the postweld heat treatment the above mentioned defect can be replaced in case of repair welding or hardfacing

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