

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 9, September 2015

Behaviour of Aluminum-Titanium Carbide Coating on Mild Steel

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ABSTRACT: The uses of Aluminium-Titanium Carbide coating have received considerable attention in recent years. Aluminium-titanium Carbide is material with high hardness, good wear resistance, and corrosion resistance. In spite of these promising properties the hardness, wear resistance, chemical resistance is not evaluated To achieve this object an experimental program was conducted. The hardness, corrosion resistance and wear resistance of Aluminium-Titanium Carbide was analyzed using varying composition of Aluminium, Titanium in different specimen. A Vickers hardness test machine had been used for testing hardness. A computerized wear testing machine is used to take a reading of wear rate. Chemical salt spray equipment was used to check chemical resistance of specimen. This report gives detail picture of Aluminium-Titanium carbide coating procedure, conduction of experiments, result analysis and application.

Keywords: Vickers hardness, wear testing, corrosion resistance

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I. INTRODUCTION

The surface coating field is a rapidly developing area of science and technology that offers new methods and techniques to control friction and wear. New coating types are continually being developed and the potential applications in different industrial fields are ever growing, ranging from machine components and consumer products to medical instruments and prostheses. Stainless steel fades and oxidizes when exposed to the environment, humidity, and other factors. The best coating option available to beautify, protect, and strengthen and stainless steel is Aluminium Titanium carbide. Titanium plating can be applied to surface of finished products such as stainless steel sheet/tubes/parts, aluminium sheets and porcelain products. Coating is a covering that is applied to the surface of an object, usually referred to as the substrate. In many cases coatings are applied to improve surface properties of the substrate, such as appearance, adhesion, wet ability, corrosion resistance, wear resistance, and scratch resistance.[2] In other cases, in particular in printing processes and semiconductor device fabrication the coating forms an essential part of the finished product. Coating and printing processes involve the application of a thin film of functional material to a substrate, such as paper, fabric, film, foil or sheet stock.[1] This article discusses what is frequently termed 'roll-to-roll' or 'web-based' coating. A roll of substrate, when wound through the coating machine, is typically called a web. Titanium is a chemical element with the symbol Ti and atomic number 22.Sometimes called the "space age metal" it has a low density and is a strong, lustrous, corrosion-resistant (including sea water, aqua regia and chlorine) transition metal with a silver colour.[2] uses of carbide coating on steel surface have received considerable attention in recent years. Carbide coated steel have recognized as one of the important wear resistant materials for structural, wear and thermal applications in industries. [5]

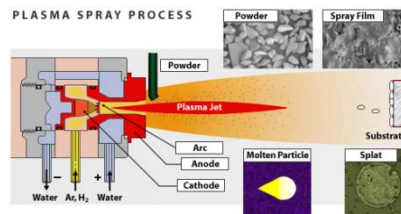
II. SYSTEM MODEL

The Plasma Spray Process is basically the spraying of molten or heat softened material onto a surface to provide a coating. Material in the form of powder is injected into a very high temperature plasma flame, where it is rapidly heated and accelerated to a high velocity. The hot material impacts on the substrate surface and rapidly cools forming a coating.[3] This plasma spray process carried out correctly is called a "cold process" (relative to the substrate material being coated) as the substrate temperature can be kept low during processing avoiding damage, metallurgical changes and distortion to the substrate material.

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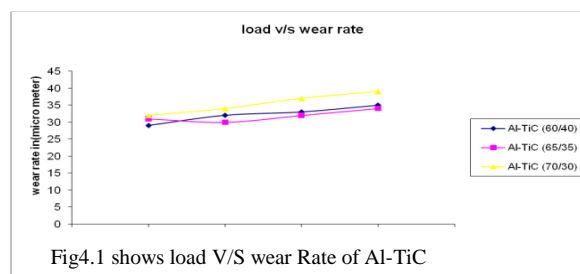
(fig2.1) Showing the plasma spray process

The plasma spray gun comprises a copper anode and tungsten cathode, both of which are water cooled. Plasma gas (argon, nitrogen, hydrogen, helium) flows around the cathode and through the anode which is shaped as a constricting nozzle. The plasma is initiated by a high voltage discharge which causes localized ionization and a conductive path for a DC arc to form between cathode and anode. The resistance heating from the arc causes the gas to reach extreme temperatures dissociate and ionize to form plasma. The plasma exits the anode nozzle as a free or neutral plasma flame (plasma which does not carry electric current) which is quite different to the Plasma Transferred Arc coating process where the arc extends to the surface to be coated. When the plasma is stabilized ready for spraying the electric arc extends down the nozzle, instead of shorting out to the nearest edge of the anode nozzle. This stretching of the arc is due to a thermal pinch effect. Cold gas around the surface of the water cooled anode nozzle being electrically non-conductive constricts the plasma arc, raising its temperature and velocity. Powder is fed into the plasma flame most commonly via an external powder port mounted near the anode nozzle exit. The powder is so rapidly heated and accelerated that spray distances can be in the order of 25 to 150 mm. [3]

III. METHODOLOGY

1. The wear analysis Aluminium Titanium carbide Al-TiC (60/40, 65/35, 70/30) gives detailed data about wearing Aluminium Titanium carbide coating in varying condition like load speed and composition.
2. The Vickers hardness of Al-TiC coatings were evaluated using computerized Vickers hardness testing machine. The test load of 0.3 kg was used.
3. Salt spray test condition.

IV. EXPERIMENTAL RESULTS



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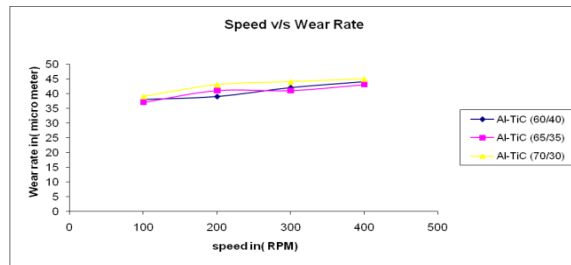


Fig4.2 shows load V/S RPM of Al-TiC

Table 4.1 showing VHN number

SL.NO	Composition (Al-TiC)	V H N
1	70/30	794
2	65/35	826
3	60/40	860

Table 4.2 Red rust observed time in hour

SL.NO	Varying Composition in % (Al/TiC)	Red rust observed time in Hours
1	70/30	17:00
2	65/35	18:00
3	60/40	18:30

Above corrosion analysis gives clear picture of corrosion resistance of Aluminium Titanium carbide coating in environment.

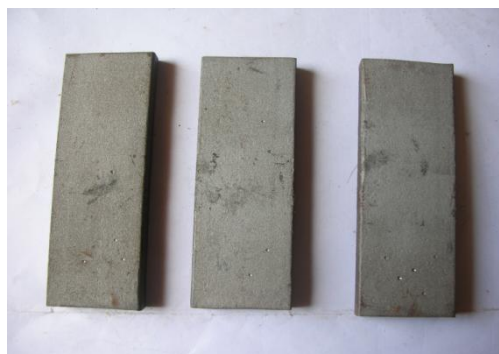


Fig4.3 Aluminium Titanium Coating on Mild Steel plate of 25 X 75 X 5mm for testing

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V. CONCLUSION

Various tests like corrosion, hardness, wear and microstructure were carried out on the surface of the coating with a varying composition of Aluminium and Titanium.

aluminium titanium carbide coatings exhibits proper distribution on the surface and less cost when compared to other hard surface coatings.

By the results obtained from various tests we came to the following conclusions.

- The surface hardness increases with the increased percentage of Titanium in the coating.
- Corrosion resistance increases with the increased percentage of Aluminium in the coating the coating with 70/30 (Al-TiC) exhibits good corrosive to other two coatings.

Present of titanium particular on the coating material increases the wear resistance. The coating with 60/40 (Al-Ti) has a good the wear resistance than other two coatings

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