CHOOSING THE PERFECT HEAD PROTECTION FOR THE PHOSPHATING PROCESS IN THE VALVE MAKING INDUSTRY

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ABSTRACT

Helmets made of light alloys or with brims along the sides should not be worn in workplaces where there is a risk of molten metal splashes. The helmet should be as light as possible and not weigh more than 400 grams. The harness, which should be flexible and liquid-permeable, should not irritate or harm the wearer. All helmets attempt to protect the user's head by preventing penetration and absorbing mechanical energy. High-energy influences change their construction and defensive limit. Because a higher volume and weight increases the risk of injury to the user's head and neck, their capacity to absorb energy is an additional important factor to take into account. Every year, construction workers suffer numerous fatalities or serious injuries as a result of head injuries. Wearing a suitable safety helmet significantly reduces the risk of harm or even death. Protecting your head could save your life. The helmet industry currently has less strength because of blow holes, uneven pressure distribution, and improper material filling. The task's goal is to adjust the current modern protective cap's material to work on its solidarity.

Keyword : - *Light Alloy , Metal, Head Protection*

1. INTRODUCTION

Head injuries account for between 3 and 6 percent of all industrial injuries in industrialized nations. They are often severe and cause a three-week average loss of time. Different types of injury have been recorded, such as perforation of the skull, fracture of the skull or of the cervical vertebrae, and brain lesions without fracture of the skull. It is difficult to understand the physical parameters that account for these injuries, and there is a great deal of disagreement in the literature. Shock-related head injuries occur when the shock's energy exceeds 100 J. Other types of injuries are less common, such as burns from splashing hot or corrosive liquids or molten material or electrical shocks from accidentally coming into contact with exposed conductive parts.

1.1 SAFETY HELMETS

The primary function of a safety helmet is to shield the wearer's head from hazards and mechanical shocks. To reduce the pressure on the skull, a safety helmet should have a hardness large enough to closely match various skull shapes and a strong shell that can withstand perforation and deformation. The harness must be securely fastened to the hard shell and be flexible enough to withstand impact deformation without touching the shell's interior. The compromise between the maximum amount of energy that the harness is designed to absorb and the progressive rate at which the shock is to be transmitted to the head should determine the rigidity or stiffness of the harness.

2.PROCESS FLOW OF PHOSPATING

Phosphating is a chemical process applied to steel parts that creates a thin adhering layer of iron, zinc, or manganese phosphates to achieve corrosion resistance, lubrication, or as a foundation for subsequent coatings or painting. The performance of a phosphate coating depends on its crystal structure and thickness, which can be controlled by varying the bath concentration, composition, temperature, and time.

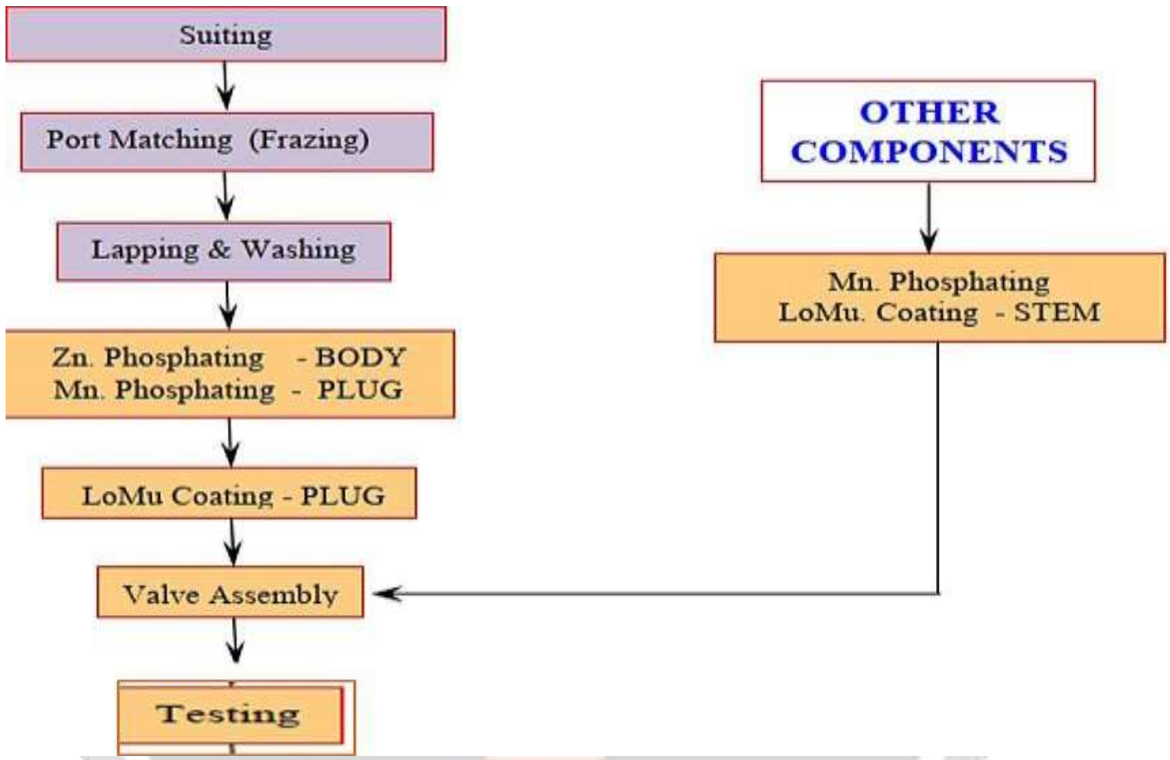

Fig -1: Process flow chart of phospating (Font-10)

2.1 THE PHOSPATING PROCEDURE

A typical phosphating procedure consists of the following steps:

- Cleaning the surface
- Rinsing
- Surface activation
- Phosphating
- Rinsing
- Neutralizing rinse (optional)
- Drying

2.2 USES OF PHOSPATING

The main uses of phosphating are:

- Corrosion protection in conjunction with organic coatings, such as paints and polymer films.
- Facilitation of cold-forming processes, such as wire drawing and tube drawing, or deep drawing.
- Corrosion protection in conjunction with oils and waxes.

- Corrosion protection with no subsequent treatment.
- Improving anti-friction properties, such as break-in, wear resistance, anti-galling and reducing the coefficient of friction.
- Providing a strong adhesion bonding for subsequent painting or an organic coating.

3. PROTECTIVE HELMET REQUIREMENT AND SELECTION

The most important idea is that safety helmets are the only way to ensure the safety of workers in industrial working environments. The type of helmet will depend on the specific nature of the physical risks identified in the risk assessment.

3.1 LABELLING OF HELMETS AND SAFETY REQUIREMENTS

EU legislation distinguishes between two areas of regulations regarding personal protective equipment: Directive 89/656/EEC and Regulation 2016/425/EU. Directive 89/656/EEC requires employers to ensure safe use of safety helmets and deliver them free of charge. Regulation 2016/425/EU requires manufacturers of hard hats to conform to essential health, safety and ergonomics requirements (EHSRs) by placing a CE mark on the product.

3.2 OPERATING MANUAL AND SAFETY INSTRUCTIONS

Manufacturer must provide safety instructions for hard hats, which should be clear and comprehensible.

4. TITANIUM AND ITS ALLOY

Titanium is a low density element that can be strengthened by alloying and deformation processing. It has good heat-transfer properties, melting points higher than steels, and can be wrought, cast, or made by PM techniques. It is formable and readily machinable.

Mill products

- Ingot
- Billet
- Bar
- Sheet
- Strip
- Tube
- Plat

Non mill products

- Sponge
- Powder

Customized product forms

- Forgings
- PM items
- Castings

4.1 SELECTION OF TITANIUM ALLOYS FOR SERVICE

Titanium is a low density element that can be strengthened by alloying and deformation processing. It has good heat-transfer properties, melting points higher than steels, and can be wrought, cast, or made by PM techniques. It is formable and readily machinable.

4.2 SELECTION OF CORROSION RESISTANCE

Titanium alloys are used for corrosion service, strength and corrosion resistance, aerospace applications, optical system support structures, and structural implants. Economic considerations, strength efficiency, and other property reasons are important factors in selecting titanium for these applications. Titanium alloys are used for corrosion service, strength and corrosion resistance, aerospace applications, optical system support structures, and structural implants. Economic considerations, strength efficiency, and other property reasons are important factors in selecting titanium for these applications.

4.3 THE TITANIUM ALLOYS

Ti6Al4V is the most used titanium alloy due to its attractive properties, work-ability, fabric-ability, production experience, and economic usage. It is also used for castings that must exhibit superior strength and PM processing. Ti6Al2Sn4Zr2Mo+Si is the most commonly used alloy for elevated-temperature applications.

OVERVIEW OF NEW SAFETY HELMETS

4.4 DEVELOPEMENT OF NEW SHELL HELMET DESIGN

A new design prototype was made, tested, and further modeled based on these design suggestions. The helmet shell's manufacturability, appearance, and structural safety were also taken into consideration at this stage of product development. Last but not least, we manufactured titanium alloy safety helmets.

4.5 METHODOLOGY

Industrial workplaces pose concurrent hazards to the upper part of the head and the eyes, which can be reduced by appropriate work organization, collective protection measures, or personal protective equipment (PPE). Protective helmets are widely used in a variety of industries, such as construction, mining, power engineering, forestry, and motorcyclists. However, the concomitant use of helmets with eye and face protectors can lead to new problems such as compatibility and additional risks. The Occupational Safety and Health Administration requires that additional equipment mounted to the helmet must not impair its protective properties.

4.6 SELECTION OF MATERIAL

The most important details in this text are the advantages and disadvantages of epoxy resin and glass fiber unidirectional as reinforcement. Epoxy resin is highly flexible and has an extensive level of properties and processing competences. It has low shrinkage and excellent adhesion with various substrates. Glass fiber is very economical and has been in the market for a long time. It has high hardness, moderate stiffness, transparency and chemical resistance, and is used in polymer matrix composites.

When wetted with polymer, it does not have a good adhesion, so a silent coating is applied on top of the glass fiber to lock it to the cross linking and get a proper adhesion. Many structural components like PCBs and other wide range of products are manufactured using glass fiber reinforced composites. The most important details in this text are the advantages and disadvantages of epoxy resin and glass fiber unidirectional as reinforcement. Epoxy resin is highly flexible and has an extensive level of properties and processing competences. It has low shrinkage and excellent adhesion with various substrates.

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4.7 DESIGN FARICATION AND ANALYSIS

A prototype of an industrial safety helmet was prepared in CATIA software and dumped in ANSYS 19 R3 version. A specimen penetration force of 14715 KN and shock absorption load of 3715 N was applied on both existing and composite material safety helmets. Fabrication of the helmet was done by adding 30% Ti-alloys as reinforcement and 70% Epoxy resin as matrix. Results showed that stress produced in Ti-alloy helmet is more than stresses produced in impact vanadium, zirconium and aluminum helmet for equal heights. Volumetric strain produced in Ti-alloy helmet is less than strain produced in Titanium, Al, Sn, Zr and Vanadium helmet for equal heights, giving more rigidity to the human neck from impact loads.

5. CONCLUSIONS

The most important details in this text are the results of a test of a safety helmet using Titanium alloy, which has properties such as electric insulation properties, resistance to lateral forces, resistance to molten metal splashes, resistance to very high temperatures, and resistance to very low temperatures. The test results showed that the Ti-alloy helmet produced more displacement than the aluminum, zirconium, and vanadium helmets, producing less volumetric strain. The composite helmet's penetration test resulted in a deformation of 0.001 m, the shock absorption test load withstands 3734 N, there was no burning in the flammability test, and there was no leakage current in the electric resistance test. The most important details in this text are the results of a test of a safety helmet using Titanium alloy, which has properties such as electric insulation properties, resistance to lateral forces, resistance to molten metal splashes, resistance to very high temperatures, and resistance to very low temperatures. The test results showed that the Ti-alloy helmet produced more displacement than the aluminum, zirconium, and vanadium helmets, producing less volumetric strain. The composite helmet's penetration test resulted in a deformation of 0.001 m, the shock absorption test load withstands 3734 N, there was no burning in the flammability test, and there was no leakage current in the electric resistance test.

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