SELECTION OF SUITABLE HEAD PROTECTION FOR PHOSPHATING PROCESS IN VALVE MANUFACTURING INDUSTRY

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ABSTRACT

Helmets made of light alloys or having a brim along the sides should not be used in workplaces where there is a hazard of molten metal splashes. the helmet should be as light as possible, certainly not more than 400 grams in weight. Its harness should be flexible and permeable to liquid and should not irritate or injure the wearer. All helmets attempt to protect the user's head by absorbing mechanical energy and protecting against penetration. Their structure and protective capacity are altered in high-energy impacts. Beside their energy- absorption capability, their volume and weight are also important issues, since higher volume and weight increase the injury risk for the user's head and neck. Every year many workers are killed or seriously injured in the construction industry as a result of head injuries. Wearing an appropriate safety helmet significantly reduces the risk of injury or even death. Protective headwear could save your life. At present strength of the helmet using industry is less due to improper filling of material, uneven pressure distribution and blow holes. The aim of the project is to increase the strength of industrial helmet by modifying the material in existing one

Keyword – *Molten Metal, Protective headwear, Hazard, and Head Injuries etc….*

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1. INTRODUCTION

Head injuries are fairly common in industry and account for 3 to 6 %of all industrial injuries in industrialized countries. They are often severe and result in an average lost time of about three weeks. The injuries sustained are generally the result of blows caused by the impact of angular objects such as tools or bolts falling from a height of several metres; in other cases, workers may strike their heads in a fall to a floor or suffer a collision between some fixed object and their heads.

Understanding the physical parameters that account for these various types of injury is difficult, although of fundamental importance, and there is considerable disagreement in the extensive literature published on this subject. Some specialists consider that the force involved is the principal factor to be considered, while others claim that it is a matter of energy, or of the quantity of movement; further opinions relate the brain injury to acceleration, to acceleration rate, or to a specific shock index such as HIC, GSI, WSTC. The chief purpose of a safety helmet is to protect the head of the wearer against hazards, mechanical shocks. It may in addition provide protection against other for example, mechanical, thermal and electrical.

Helmets used for different purposes have different designs. For example, a bicycle helmet must protect against blunt impact forces from the wearer’s head strikingthe road. A helmet designed for rock climbing must protect against heavy impact, and against objects such as small rocks and climbing equipment falling from above.

2. LITERATURE SURVEY

Introduction related your research work Introduction related your research work Introduction related your research work Introduction related your research work Introduction related your research work Introduction related your research work Introduction related your research work Introduction related your research work Introduction related your research work The literature towards the design methodologies and analysis techniques proposed by different authors is collected and presented in the subsequent paragraphs.

(Christianetal.2003)hasdoneastudyonidentifytheimpactofmotorcyclehelmet use on patient outcomes and cost of hospitalization, in a state with a mandatory hel- met law. Patients admitted after motorcycle crashes from July 1996 to October 2000 werereviewed,includingDemographics,InjurySeverityScore,lengthofstay,injuries, outcome, helmet use, hospital cost data, and insurance information. Statistical analysis was performed comparing helmeted to unhelmeted patients using analysis of variance, Students test, and regression analysis. Admitted 216 patients, 174 wore helmets and 42 did not. Injury Severity Score correlated with both length of stay and cost of hos- pitalization. Mortality was not significantly different in either group. Failure to wear a helmet significantly increased incidence of head injuries (Students test, p $ 0.02), but not other injuries. Helmet use decreased mean cost of hospitalization by more than $ 6, 000 per patient. Failure to wear a helmet adds to the financial burden created by motorcycle-related injuries. Therefore, individuals who do not wear helmets should pay higher insurance premiums.(Ginsberg and Silverberg1994) investigated legisla- tionrequiringbicycliststowearhelmetsinIsraelwill,overahelmets5-yearduration (assuming 85% compliancy, 83.2% helmet efficiency for morbidity, and 70% helmet efficiency for mortality), save approximately 57 lives and result in approximately2544 fewerhospitalizations.13,355and26,634feweremergencyroomandambulatoryvis- its, respectively; and 832 and 115 fewer short-term and long-term rehabilitation cases, respectively.

(Prinsen et al. 2000) has studied about the lack of consensus among pre-hospital personnel (athletic therapists, paramedics, sport physiotherapists) concerning specific aspects of initial care and assessment of injured athletes presenting signs and symp- toms of a cervical spine injury (CSI). In instances of serious injury involving the head or spine, complicated by altered levels of consciousness, protective equipment suchashelmetsandshoulderpadsmayprovideahindrancetoprompt,safe,andefficient management. Specifically, there is disagreement concerning the need or advisabilityof removing protective head gear, as in the case of football and hockey athletes. Using the technique of fluoroscopy, the cervical spine displacement of 21 male football and hockey athletes was determined while wearing protective shoulder pads and protective head equipment at the following times during helmet removal, during cervical collar application, as the helmetless head was allowed to rest.

(Pramudita et al.2010) discovered that when foaming ratio of the liner and theshell thickness were varied, indicated that there is an optimum combination where the shell part fails without the liner bottoming, improving the shock absorption ability of a helmet.

3. PROCESS FLOW OF PHOSPATING

Phosphating is a conversion coating applied to Steel and Iron components. In its basic form, the process involves immersing a component in a dilute solution, which converts thesurfaceofthemetalintoalayerofmicroscopicPhosphateCrystals.Phosphatingisa chemical process for treating the surface of steel where barely soluble metal-phosphate layers are formed on the base material. The layers created are porous, absorbent and suitableasaconversionlayerforsubsequentpowdercoatingwithoutfurthertreatment. Phosphate conversion coating is a chemical treatment applied to steel parts that creates a thin adhering layer of iron, zinc, or manganese phosphates, to achieve corrosion re- sistance, lubrication, or as a foundation for subsequent coatings or painting. It is oneof the most common types of conversion coating. The process is also called phosphate coating, phosphatization, phosphatizing, or phosphating. It is also known by the trade name Parkerizing, especially when applied to firearms and other military equipment.

The main phosphating step can be preceded by an ”activation” bath that creates tiny particles of titanium compounds on the surface. The performance of a phosphate coat- ingdependsonitscrystalstructureaswellasitsthickness.Amicrocrystallinestructure is usually best for corrosion resistance or subsequent painting. A coarse grain structure impregnated with oil may be best for wear resistance. These factors can be controlled by varying the bath concentration, composition, temperature, and time.

4. PROTECTIVE HELMET REQUIREMENT AND SELECTION

In many industrial working environments, for example, mining, power, construction, and forestry, the risk of head injury to workers is constantly present. The most serious risks are physical injuries, which can be as a result of the impact of a falling object or collision with fixed objects at the workplace. Due to the nature of these work activities, it is not always possible to eliminate such risks with just appropriate organisational solutions or collective protective equipment. Therefore, the only way to ensure the safety of workers is by using safety helmets. The type of helmet will depend on the specific nature of the physical risks that have been identified in the risk assessment undertaken for the activity. This article provides information for users of protective helmets as well as employers and OSH engineers. It includes information on definitions and gives the requirements for different in dof protective helmets that offer protection against physical risks.

4.1 LABELLING OF HELMETS AND SAFETY REQUIREMENTS

EU legislation distinguishes between two areas of regulations regarding personal pro- tectiveequipment.ThefirstisdiscussedinDirective89/656/EEC,whichdeterminesthe obligations of the employer regarding ensuring safe use of personal protective equip- ment. The provisions of this Directive also include employers obligations connected with the necessity to use personal protective equipment. Safety helmets should be appropriately selected by the employer, based on a risk analysis, and delivered to the employees free of charge. The employer is also responsible for the maintenance of safety helmets and their replacement, in particular if the used items have reduced protective properties.

The second area of regulations with regards to personal protective equipment is connected with Regulation 2016/425/EU . It concerns the rules of placing the products on the common market, i.e. the assessment of conformity with essential health, safety and ergonomics requirements (EHSRs). According to EN 397, the most common and basic form of PPE aimed at protecting an employees head is an industrial safety helmet. Regardless of the differences in their structural protection these type of helmets will feature the following components: shell, harness and headband.

4.2 PROPER USE OF THE SAFETY HELMETS

Proper use means following the rules and instructions specified by the manufacturer in the operating manual e.g. conditions and ways of using the product, recommended methods of maintenance and storage as well as the conditions for qualifying a helmet for withdrawal from service.

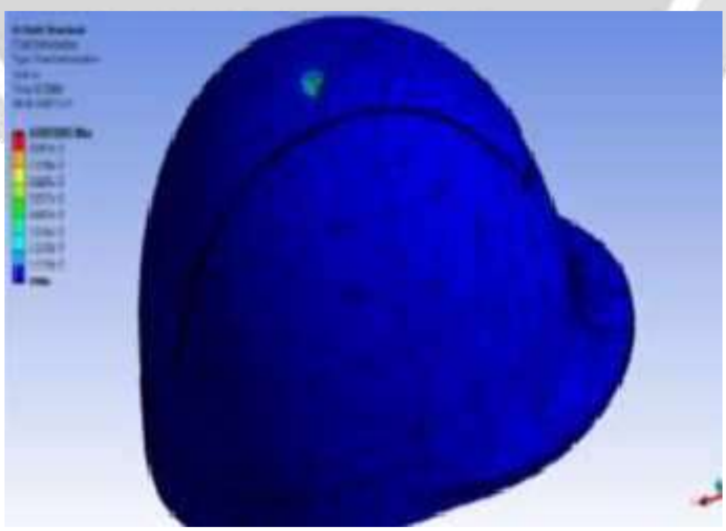

Fig 4.1 Impact analysis on prototype safety helmet of COMPOSITE material

The most important rules of proper use of safety helmets include:

- Prior to using, a helmet must be fitted to the users head by proper adjustment: of the headband, height of wearing and the length of the chinstrap (if it ispresent).
- Helmet must be withdrawn from service if it was exposed to a strong impact or shows signs ofdamage.
- Interior elements of a safety helmet must be regularly inspected (harness, head- band, sweatband) as they are exposed to sweat, dust, etc. These factors cause an accelerated degradation of the materials of which the helmet components are made. Parts inside the helmet shall be replaced as often as required by themanu- facturer and every time any damage is detected during inspection. In the case of doubts, interior elements shall be replaced or the entire helmet substituted by a newone.
- Helmetshouldbewithdrawnfromserviceifitsexpirydate,specifiedbytheman- ufacturer in the operating manual, haspassed.Helmet shall be stored in compliance with the conditions specified by the man- ufacturer, which pose no threat of losing its safety parameters (far from heat sources, direct solar radiation,etc.).
- The construction of the helmet must not be modified by users, no stickers shall be attached to the shell nor shall it be painted,etc.

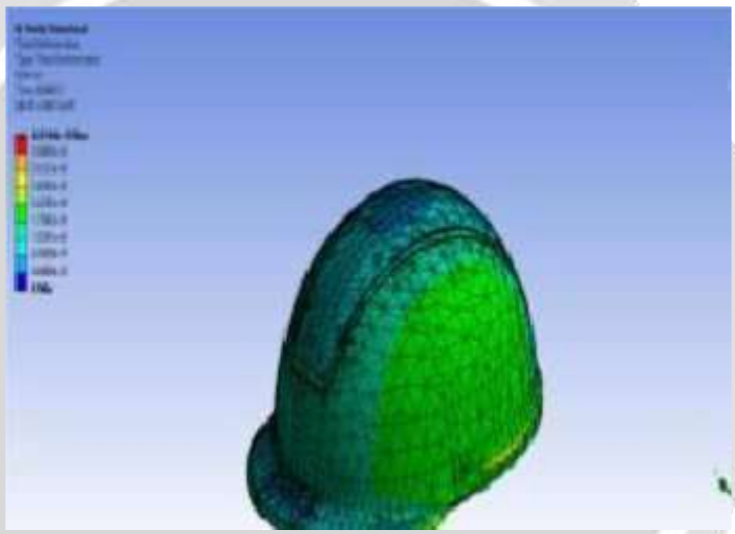

Fig 4.2 Shock absorption analysis on prototype safety helmet of COMPOSITE material

5. CONCLUSIONS

In many industrial working environments, for example, mining, power, construction, and forestry, the risk of head injury to workers is constantly present. The most serious risks are physical injuries, which can be as a result of the impact of a falling object or collision with fixed objects at the workplace. Due to the nature of these work activities, it is not always possible to eliminate such risks with just appropriate organisational solutions or collective protective equipment. Therefore, the only way to ensure the safety of workers is by using safety helmets.

Stress produced in TI-alloy helmet is more than stresses produced in impact vana- dium, Zirconium and aluminum helmet for equal heights. It indicates that the resistance against the load per unit area, factor of safety is more,and withstanding capacity of Sn is more. From the results it is proved that displacement produced in Ti-alloy helmet is more than in aluminum, Zirconium and vanadium helmet for equal heights. It shows thatthedisplacementofhelmetcannotbealteredtohighandtheimpactofloadonhel- met is less. Volumetric Strain produced in Ti-alloy helmet is less than strain produced in Titanium, Al, Sn, Zr and Vanadium helmet for equal heights which gives more rigidity to the human neck from impact loads. Even though the geometric specifications of both prototype helmets are same and same impact load and shock absorption load was applied on both helmets. But the maximum total deformation of Ti-alloy is 0.0005 m and maximum total deformation of COMPOSITE material is 0.0001 m of impact analysis. The maximum total deformation of Ti-alloy is $4.034*10^{-7}$ m and maximum total deformation of Composite material is $4.01*10^{-8}$ of shock absorption analysis in AN- SYS software. In practical testing result of composite material helmet Penetration test deformation of helmet is 0.001m, shock absorption test load withstands 3734 N, No burning in Flammability test and No leakage current in electric resistance test. Practical testing of existing safety helmet penetration test and shock absorption test is 0.004m and 2647 N respectively; remaining test results are as same as composite material helmet.

In this project we have fabricated and tested a safety helmet using Titanium alloy which has a properities of

- Electric insulation properties
- Resistance to lateral forces
- Resistance to molten metal splashes
- Resistance to very high temperatures
- Resistance to very low temperatures.

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