

Design and analysis of weightless bullet proof jacket

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Abstract: Bullet proof jacket is protection equipment, such as a bullet proof vest is a soldier's most important means of preserving life and health. The main aim of our project is to reduce the weight of the bullet proof jacket and improve the quality of a jacket. Our bullet proof jacket is looks like a normal bullet proof jacket but it was made some additional work for improve a weight reduction work in it. Bullet proof jacket must be a polymer coting in used for reduce the bullet force.

Keywords: Bullet Proof Jacket, Weight Reducing, Polymer material.

I. INTRODUCTION

In this we are going to do a project under a reducing a weight in bullet proof jacket. This was made by a help of composite material is combining of metal plate with a polymer. While doing like this means the weight of the bullet proof jacket will be reduced and also the bullet resistance power will be equally increased. The main reason of reducing the weight in bullet proof jacket is to give a comfortable for army persons in war zone. When they are use a normal bullet proof jacket continues in war zone or in protection areas means they were easily get affected by a shoulder pain.

II. LITERATURE REVIEW

Anna Ignatova (2010)

He suggested concise summary of mineral alloys as materials are used for bulletproof vests for improving the quality and reducing the weight of the bullet proof vests as he used the materials of mineral alloy. But he did not get succeed.

Naveen Kumar (2012)

Their research in improving of bulletproof vests by changing some fabricating methods in bullet proof jacket manufacturing. In their research he find a solution to improve to absorb the bullet impact force by mixing of fibers include with nylon yarn.

Magdalena Zwolińska (2011)

In the case of ballistic vests this aspect can be assessed by testing the vest's thermal insulation properties, which is to say, by determining to what extent the vest

impedes the transmission of heat from the human body to its surroundings.

EASK Fernando (2015)

He design a bullet proof jacket by using shear thickening fluid for possibility of using a Shear

Thickening Fluid was explored in order to reduce the amount of textile fabric used.

III. PROBLEM IDENTIFICATION

The main problem in non-moderate TYPE-IV BULLET PROOF JACKET is weight. The weight of type-IV bullet proof jacket is more than 20kg. When our soldier's in war field they should want to wear the bullet proof jacket to protect their health from enemy. Due to the weight of the bullet proof jacket army persons can easily affected by shoulder pain which leads to bone damage. So our idea is to reducing the weight of bullet proof jacket by reducing the thickness of harden metal plate used in bullet proof jacket and appalling an polymer coting both side on the metal plate.

IV. PROPERTIES OF MATERIAL MATERIAL PROPERTIES

The property of Full Cure 720 and Mild Steel is given table 4.1.

Material used	Full cure 720	Mild steel plate
Elongation in %	20	1.3
Density in gms/cm ³	1.19	7.85
Strength in Gpa	76	480
Factor of safety	2.4	2.5
Poisson's ratio	0.28	0.3
Max Temp	49	760

TABLE 4.1: Properties of Material

V METHODOLOGY

At present, ANSYS software is widely used in finite element analysis, but its pre-process function is so complex that we must spend too much time and energy, especially for complex model. In our project we have used Solid Works for modeling and ANSYS for meshing and analysis.

The comprehensive application of various finite elements software can exert their corresponding advantages and makes the analysis more efficient.

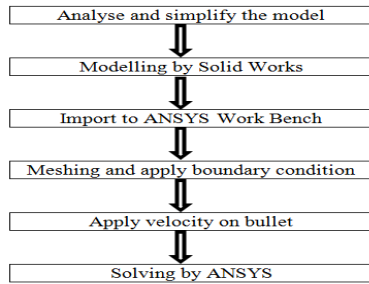


Fig.4.1: Steps Involved in Analysis

DIMENSION OF FIBER MATERIALS:
 Thickness of polymer material = 60mm
 Dimension of bullet proof material = 110 x 90mm
 Diameter of bullet = 12mm

Velocity of bullet = 879 m/sec
CALCULATION:
 Thickness of polymer = 60mm
 Velocity of bullet = 879m/sec
 End time = (thickness of plate) / (velocity of bullet) = 0.06/879 = 0.0000683 sec

VI. RESULTS AND DISCUSSIONS
TOTAL DEFORMATION:

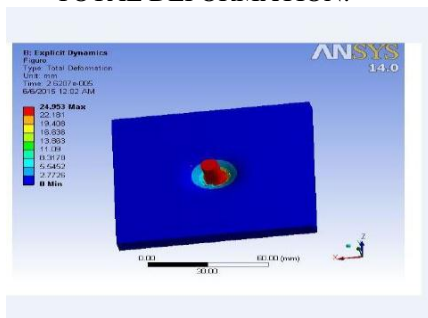


Fig.5.1 Total Deformation of Bullet Proof Jacket

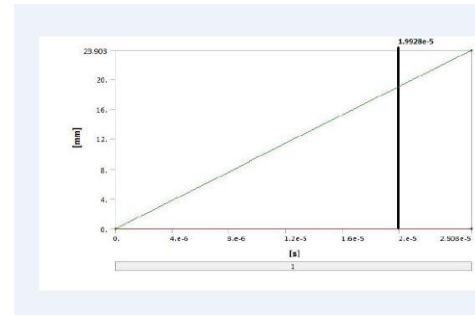


Fig.5.2 Total Deformation Chart of Bullet Proof Jacket

In dynamics analysis, the model has been extracted in IGES format. Here the material which is subjected to boundary conditions such as the plate has been fixed and given a bullet velocity as 879 m/sec indented on a plate. The above Fig.5.1&5.2 shows the total deformation along Y-axis. It is found that maximum Deformation in the plate is 24.953mm.

MAXIMUM PRINCIPAL STRESS:

The principal stress for polymer and mild steel material.

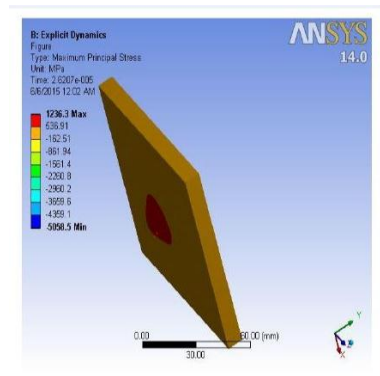


Fig.5.3 Maximum Principle Stress of Bullet Proof Jacket

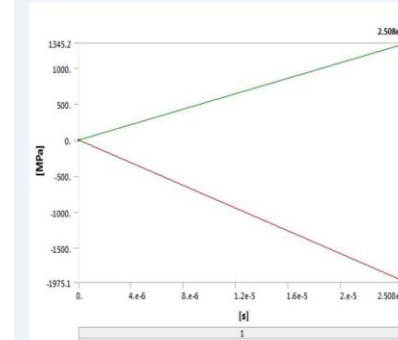


Fig.5.4 Maximum Principle Stress Chart of Bullet Proof Jacket

In dynamics analysis, the model has been extracted in IGES format. Here the material which is subjected to boundary conditions such as the plate has been fixed and given a bullet velocity as 950 m/sec indented on a plate. The above Fig.5.3 & 5.4 shows the Maximum and Minimum Principal Stress. The maximum principal stress of the plate is 1236.3Mpa and minimum principal stress is -5058.5Mpa.

DIRECTIONAL DEFORMATION ALONG Y DIRECTION:

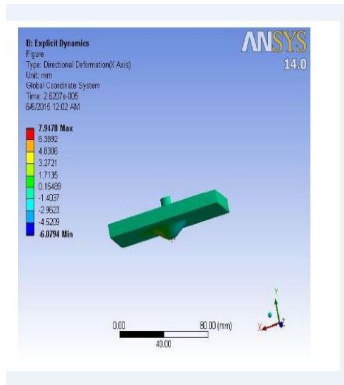


Fig.5.5 Directional Deformation of Bullet Proof Jacket

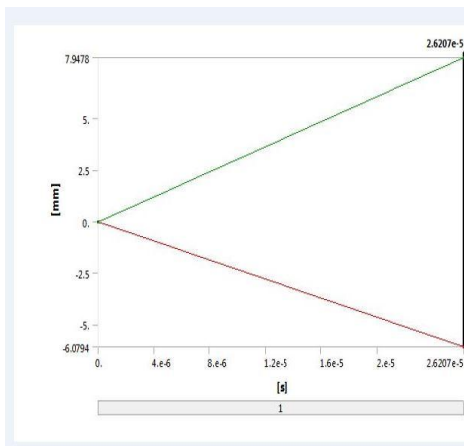


Fig.5.6 Directional Deformation Chart of Bullet Proof Jacket

In dynamics analysis, the model has been extracted in IGES format. Here the material which is subjected to boundary conditions such as the plate has been fixed and given a bullet velocity as 879 m/sec indented on a plate. The above Fig.5.5 & 5.6 shows the directional deformation. Directional deformation along y direction of the plate is 7.9478 mm.

MAXIMUM SHEAR STRESS:

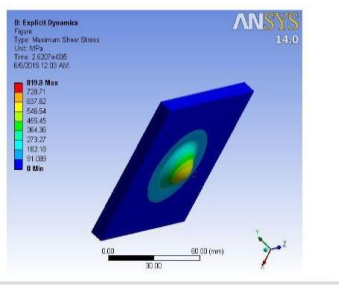


Fig.5.7 Maximum Shear Stress of Bullet Proof Jacket

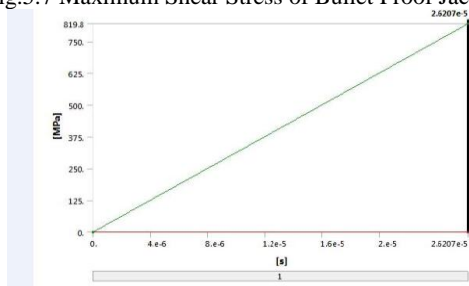


Fig.5.8 Maximum Shear Stress Chart of Bullet Proof Jacket In dynamics analysis, the model has been extracted in IGES format. Here the material which is subjected to boundary conditions such as the plate has been fixed and given a bullet velocity as 879 m/sec indented on a plate. The above Fig.5.7 & 5.8 shows the maximum shear stress. Maximum shear stress of the plate is 819.8Mpa.

CADD MODEL

In this CADD model is only created for polymer material that model is shown in Fig.5.9. Then this model is uploaded in 3D printing machine. After that the machine will print the model in this model we create a small cut. That cut is used to insert the mild steel plate into that place. Due to this the weight of the bullet proof jacket will be reduced.

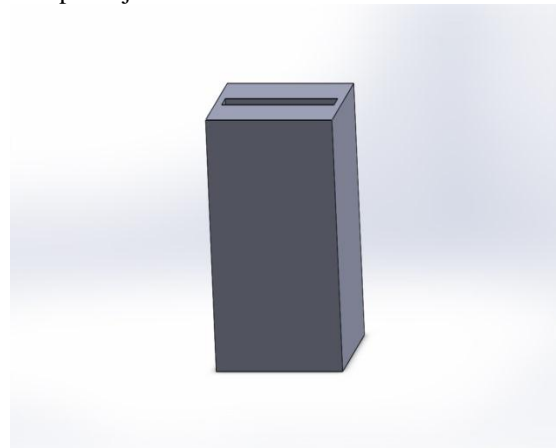


Fig.5.9 CADD Model of Bullet Proof Jacket

VII. CONCLUSION

Finite element analysis is carried out on the Full Cure 720 and Mild steel to determine the deformations and stresses when it is struck with high bullet of velocity 879m/sec. While comparing of other materials using of polymers and mild steel is gives good result. They are having the desired mechanical properties like higher strength, resistance to chemical reactions, negligible moisture sensitivity.

REFERENCES

- [1] Pushpa Bajaj &Sriram,' "Ballistic protective clothing; an overview" Indian Journal of Fibre&Textile Research Vol.22, December1997, pp274-291.
- [2] Kin HerbenYeung&Khamenei Pitches ware Rao, "Mechanical properties of Boron & Kevlar 149 Reinforced thermosetting composite Economic implications" Journal of Engineering Science Vol 10,19-29,2014.
- [3] PurnaSingh, Vikas Malik, Priyawast Lather, "Analysis of Composite Materials Used In Bullet Proof Vests Using FEM Technique" International Journal of Scientific & Engineering Research, Volume 4, Issue 5, May-2013 ISSN 2229-5518.

[4] RimanatasBarauskas, AusraAbraitiene, "Computational analysis of impact of a bullet against the multilayer fabrics in LS-DYNA" International journal of impact Engineering34 (2007)1286-1305.

[5] Deju, BarzinMobasher, SDRajan, "Experimental Study Of Dynamic Behavior Of kevlar149 Proceeding of the SEM."