ISSN 2348 – 8034
Impact Factor- 5.070

GLOBAL JOURNAL OF ENGINEERING SCIENCE AND RESEARCHES

DESIGN AND ANALYSIS OF SAFETY SHOE TOE CAP

Ved Prakash*[1] & Diwesh B. Meshram[2]
*[1]Research scholar, Plastic Engineering CIPET: IPT, Lucknow226008, India
[2]Assistant Technical Officer, CIPET: IPT, Lucknow226008, India

ABSTRACT

Toe caps are the protective devices that are worn in the industry to protect the feet of the workmen from impact and compression load. In general Steel is mostly used for safety shoe toe cap which are heavy and have high thermal conductivity but now the use of polymer composite is increasing because of their low weight and low thermal conductivity. This research focuses on design and analysis of safety shoe toe cap using nylon 66 and carbon fiber (CF) in different weight ratios. Designing of safety shoe toe cap is done in Siemens NX Unigraphics followed by Finite Element Analysis (FEA) using ANSYS software. EN12568:2010 standard is followed to perform static and dynamic analysis followed by comparison with steel shoe toe cap..

I. INTRODUCTION

With the advances in science and technology there has been remarkable progress in the field of safety shoe toe cap but not much been much progress has been made on the research and analysis of the safety toe cap particularly made out of high achievement plastic element. It has been rightly static that the 21th century is the era of the plastic i.e. Plastic age, therefore it is only decided to try and not replace ordinary elemental which were earlier made of metal. Today plastic make up percent of the content of new proposed in this thesis is a design of an toe cap which can be made of the engineering plastics material which work on a modified safety toe cap. This project has been modeled by using computer simulation software packages like Catia, NX;AutoCAD has been analysis by the package Ansys. Ones the design was achieved. The design of the plastic engaging has been drafted considering the factors and the modules that are suitable to engineering plastic with heavy load being the most significant factors losing weight is not just a desire for all human being is it also the key in designing a perfect safety toe cap the desirable quality like safety shoe toe cap in the world. The light weight the better plastic safety toe cap used in long term and weight reduction is certainly the major motive behind it.

The idea of plastic toe cap design is evolutionary coveting the safety toe cap to plastic would be a heavy load in the field of shoe as the evolved safety shoe will not only be 40% light but also cheaper using plastic not only allows for lighter shoe but provides the added advantages of reduced. The design of the safety shoe toe cap used today is complex in nature, measuring all dimension the design was created using CATIA,NX. The safety shoe toe cap after design the component material it will go through several analyses and analyze the stresses on nylon 66, Carbon fiber

II. MATERIAL USED

Material that we used are

- Nylon66 and
- Carbon Fiber

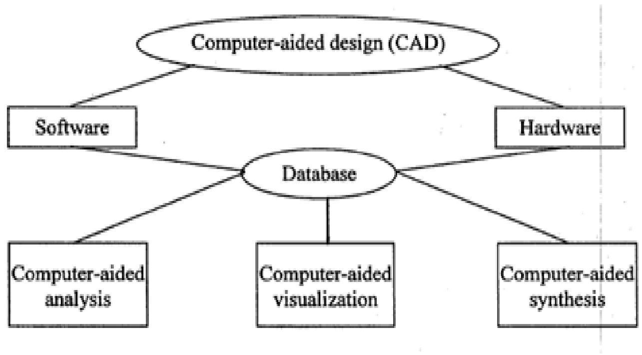
Carbon fiber reinforced polymer is an extremely strong and light weight fiber reinforced polymer thus makes itself a better replacement for steel toe cap with are bulky and expensive.

III. LITERATURE SURVEY

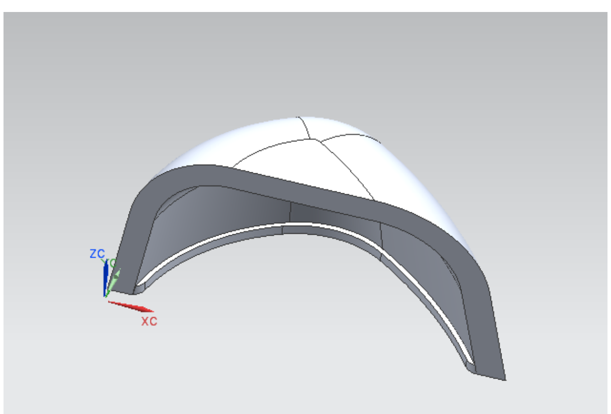
"Bergquist and Abeysekera, 1994An intensive literature review is made to understand the extent of scientific work done on footwear human tribology, Safety shoe Toe Cap, slip resistance, footwear bottom design, floor conditions and contaminants those affecting the safety aspects of walking and running. As indicated by a poll overview "(Bergquist and Abeysekera, 1994) and 3 properties of cool humidity of wellbeing shoes were given high request: great wellbeing, thermal comfort and security from work chance. The most elevated recorded issue was on footwear of warm solace (57%). Of this, 43% identified with aggravation and frigidity sensation associated with the steel toe top and its gathered cooling impact. It is the examinations have not demonstrated any indisputable successful of the steel toe top on the warm properties of the shoe".

"Oakley (1984) considered the task of military boots beneath field conditions. It is the show of results that toe skin temperatures fell quickly, especially when the individual was lethargic wide open to the harshe elements. They may warm up amid work out, yet fell quickly when the activity stopped. This calm fall could be faster, if sweating had made the footwear wet. Dampness either retained from the outer or inward decreases the protection. Alike outcomes are likewise revealed by Bunten (1982)".

Design



The 3D model of toe cap is designed in Proe-E.



IV. ANALYSIS

Analysis of the toe cap is done in Ansys software .
4 mm Simple Cap
Total deformation

ISSN 2348 – 8034
Impact Factor- 5.070

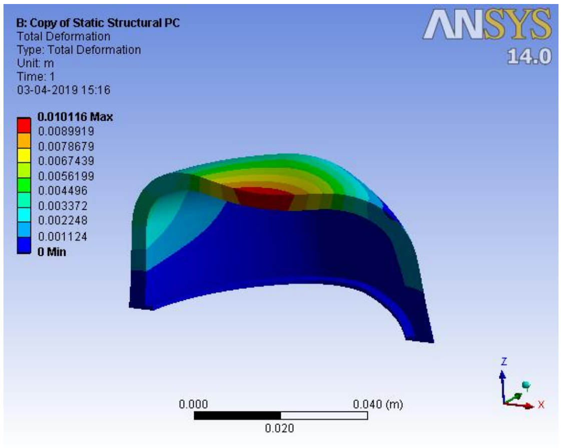


FIG. PA 66

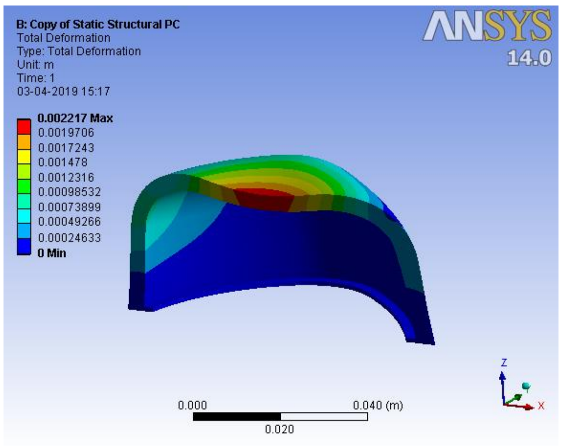


FIG. PA66+ 20 CF

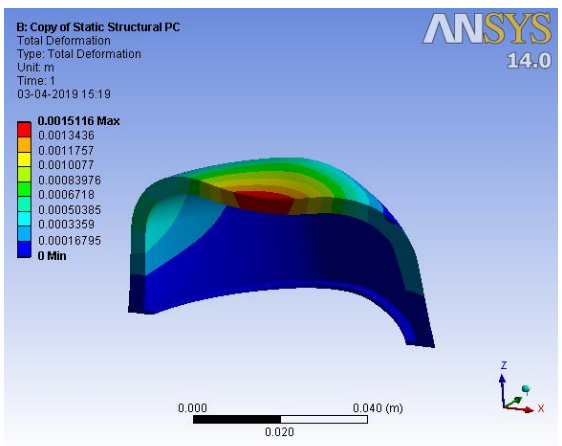


FIG. PA66+ 30 CF

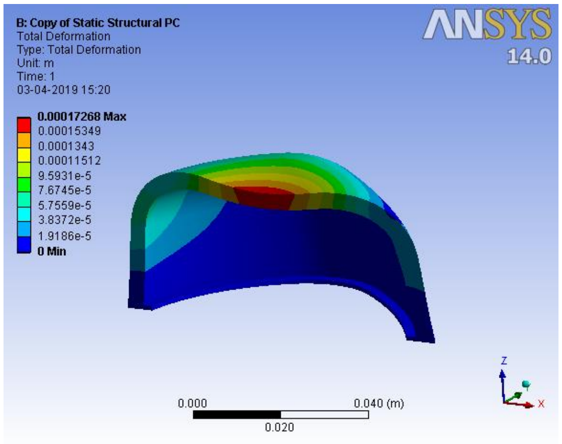


FIG. SS

Principle stress

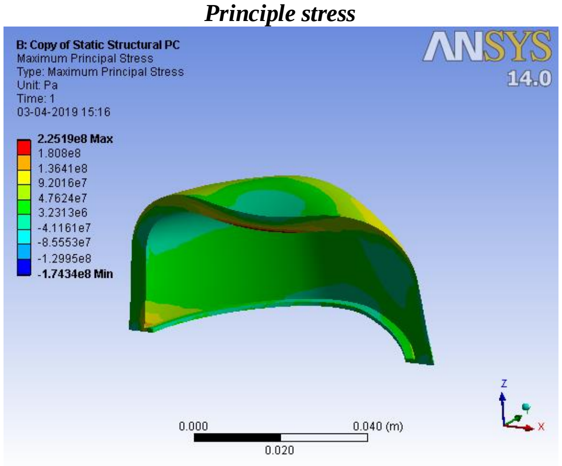


FIG PA 66

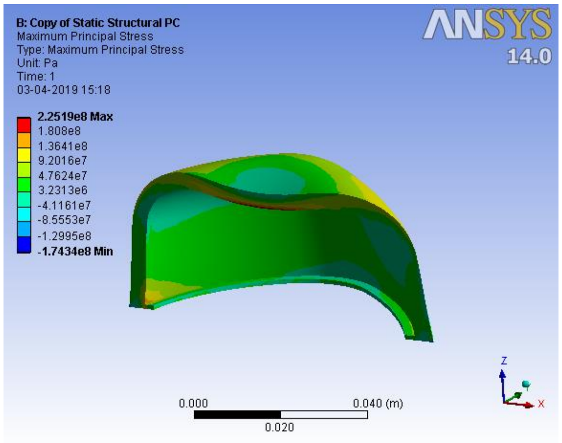


FIG PA66+ 20 CF

ISSN 2348 – 8034
Impact Factor- 5.070

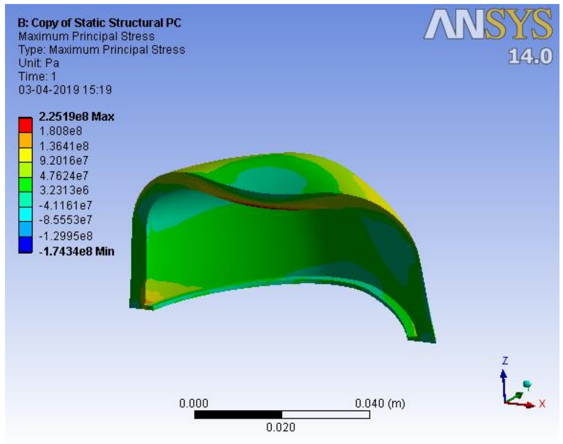


FIG PA66+ 30 CF

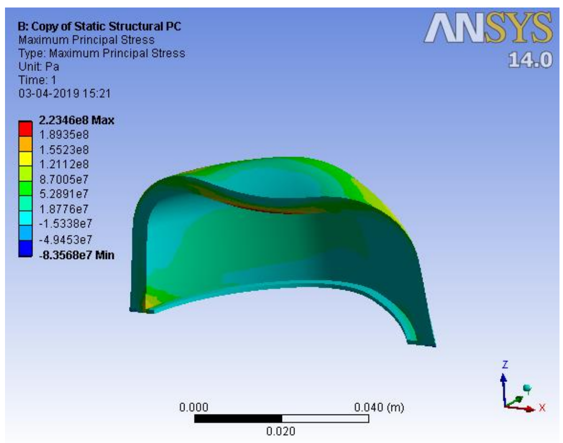


FIG SS

Principle Strain

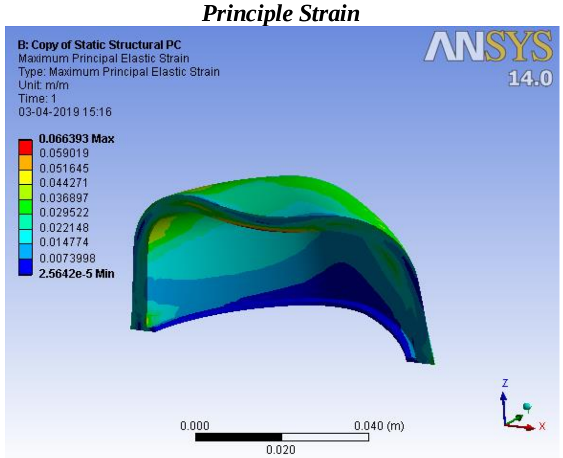


FIG PA66

ISSN 2348 – 8034
Impact Factor- 5.070

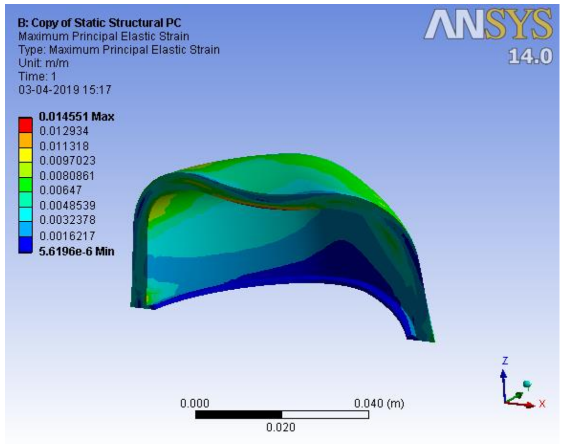


FIG PA66+ 20 CF

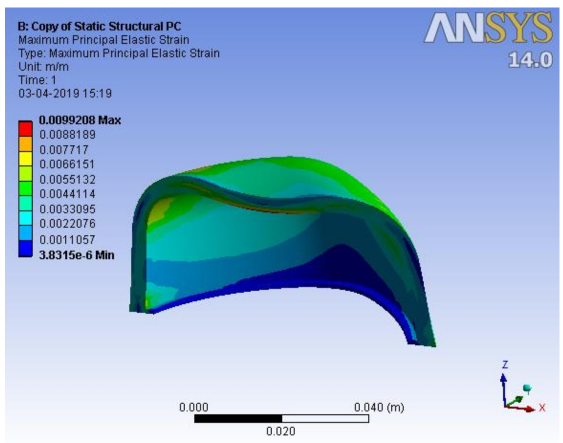


FIG PA66+ 30 CF

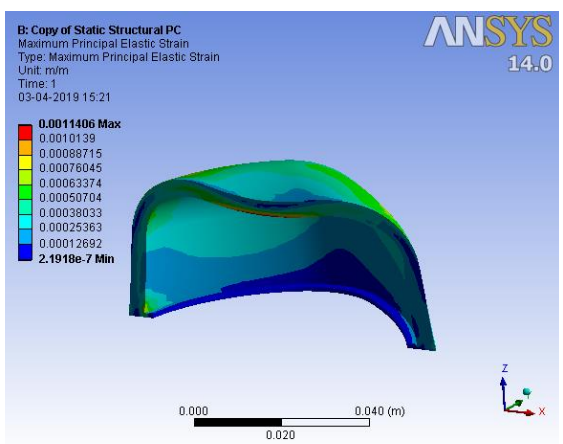


FIG SS

ISSN 2348 – 8034
Impact Factor- 5.070

4 mm Honeycomb
Total deformation

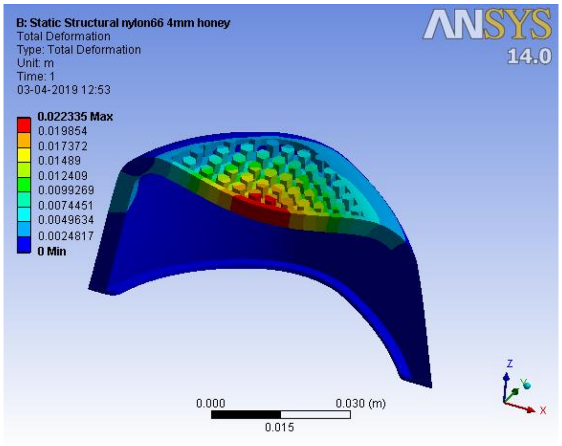


FIG PA 66

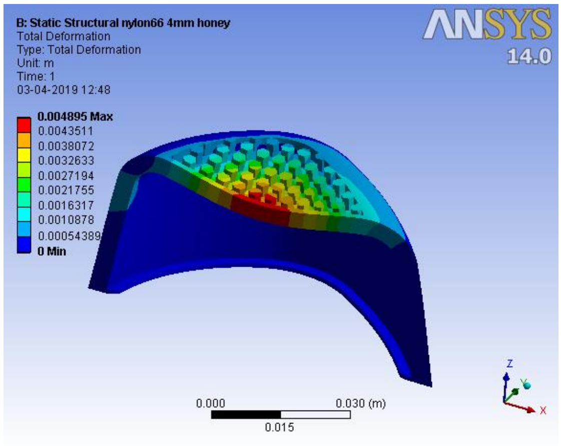


FIG PA66+ 20 CF

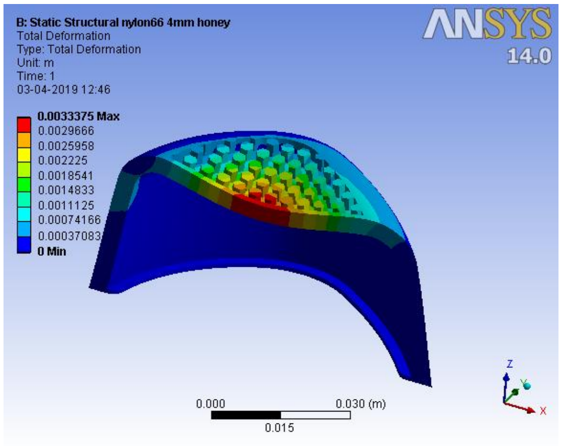


FIG PA66+ 30 CF

ISSN 2348 – 8034
Impact Factor- 5.070

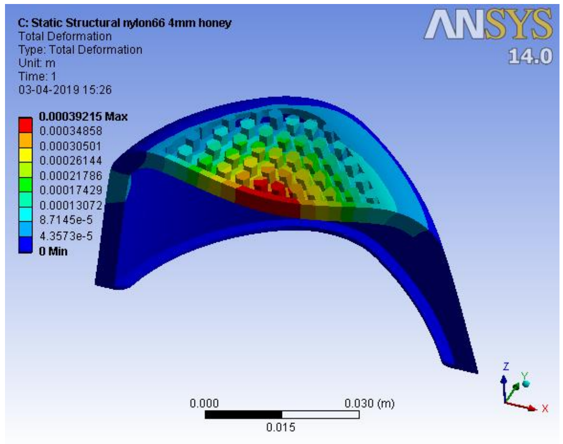


FIG SS

Principle stress

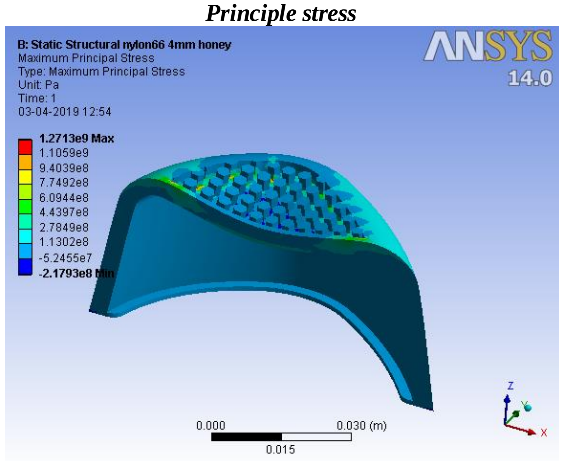


FIG PA 66

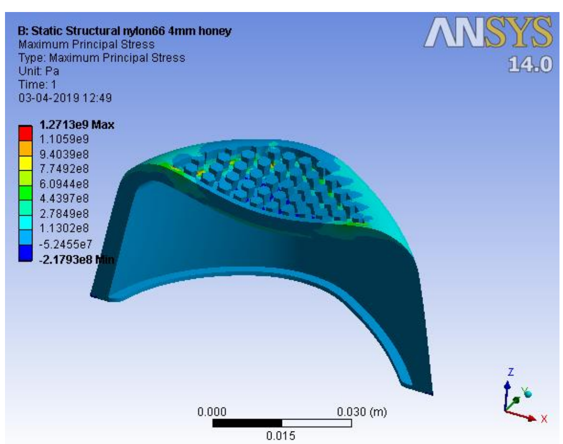


FIG PA66+ 20 CF

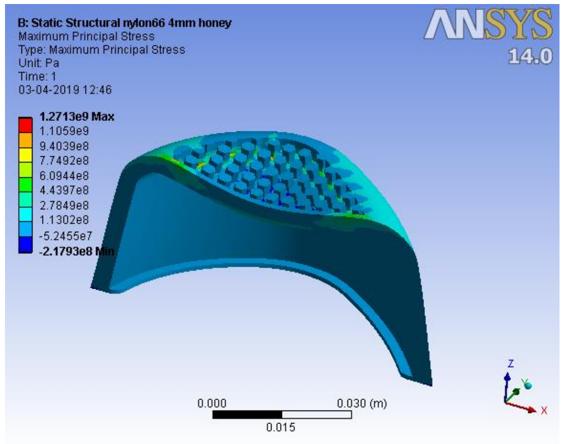


FIG PA66+ 30 CF

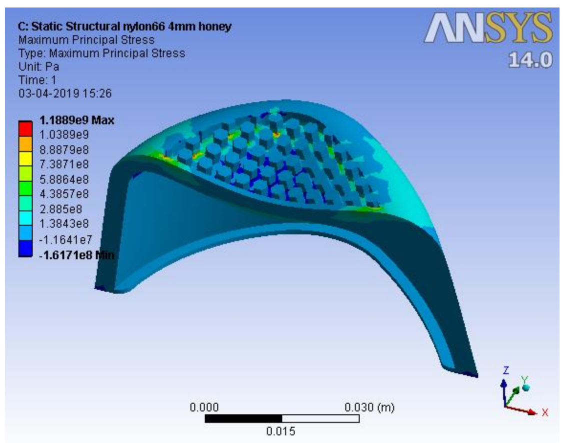


FIG SS

Principle Strain

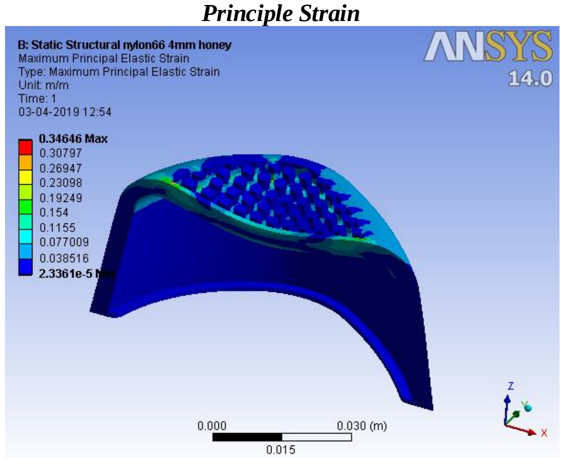


FIG PA 66

ISSN 2348 – 8034
Impact Factor- 5.070

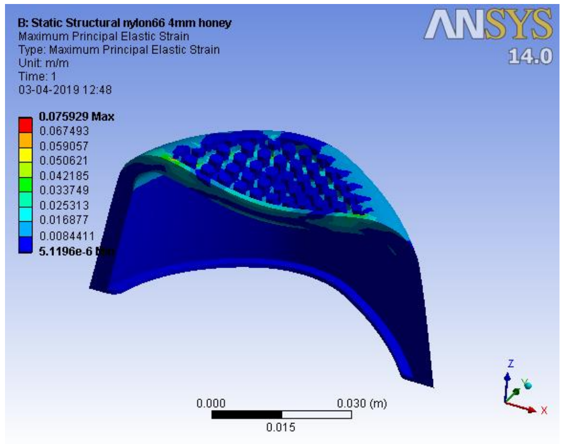


FIG PA66+ 20 CF

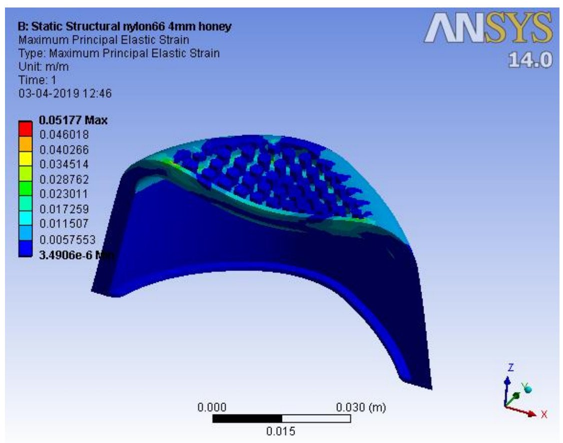


FIG PA66+ 30 CF

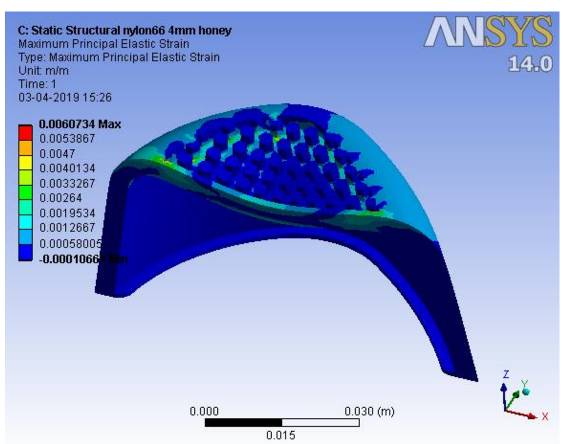


FIG SS

V. RESULT AND DISCUSSION

The deformation of plastic material are compared to metal therefore it is more important to consider the deformation when plastic product of material Nylon 66 and load apply force 20000N in ANSYS software. A few plastic deformations acquired hardest difficulties thickness decrease of the regularizing part and expanded spotlight on configuration with a specific end goal to understand a brilliant method to lessen weight and enhance execution to new model.

		Total deformation Maximum (mm)	Maximum Principal Elastic Strain	Maximum Principal Stress (GPa)
Simple Toe Cap	PA66	10.116	0.06639	0.2251
	PA66+ 20 CF	2.217	0.014551	0.2251
	PA66+ 30 CF	1.5116	0.00992	0.2251
	SS 30	0.1726	0.00114	0.22346
Honeycomb toe cap	PA66	22.335	0.34646	1.2713
	PA66+20CF	4.895	0.0759	1.2713
	PA66+30CF	3.3375	0.05177	1.2713
	SS30	0.392	0.00607	1.1189

REFERENCES

1. *book, A History of boots and shoes by J. Sparkes Hall. Available in https://archive.org/details/bookfeetahistor00hallgoog Accessed date- 03.01.2015*
2. *European commission trade export help desk. Classifying footwear.(online) Available from EN Classifying footwear*
3. *The fascinating of footwear, All that is Interesting 23/04/2013 retrieved 24/10/2016 Report by BATA. All about our shoes Materials& Pictograms. available from: http://www.bata.com.sg/products/materials-pictograms.html accessed 01.03.2015*
4. *book, A History of boots and shoes by J. Sparkes Hall. Available in, https://archive.org/details/bookfeetahistor00hallgoog Accessed date- 03.01.2015*
5. *book - The Science of Footwear (Human Factors and Ergonomics) by Ravindra S.Goonetilleke*