

Conserving Impact On Two Wheeler Helmet with Phase Change Substance

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Abstract: The most unusual discomfort is that, heavy sweat happens because of immoderate warmness formation. This especially focuses on soaking up the warmth produced within the helmet. To attain this, a suitable phase change substance/fabric is packed into a pouch and located among the helmet and the wearer head is transferred to the phase change substance by using conduction thru a heat collector that is unfold over the wearer head. The cooling unit is capable of offer consolation cooling up to 4.99hrs when the phase change substance, is completely melted. The phase change substance helmet cooling machine is straight forward and has potential to be implemented as a sensible strategy to offer consolation cooling to the motor cycle riders. Our intention is to make consolation on head sweat because of carrying helmet. Immoderate heat and sweat formation due to wearing of helmet. It's high time to locate an effective and financial answer for this trouble. This task seeks a realistic answer for this problem using phase change substance.

Keywords: Two Wheeler Helmet, Heat Collector, Phase Change Substance, Cooling Helmet.

I. INTRODUCTION

These days, due to unexpectedly developing populace, visitor's congestion and lack of parking area, two wheelers are the most popular mode of transportation. Inside the growing nations like India, it's far very tough to the centre class people to afford the posh cars for day by day desires. Hence the 2 wheeler motor cycles are very essential for them. Due to this, the usage of motor cycle is increasing steadily in India. In India most of the accidents includes the two wheelers, subsequently the protection of the motor cycle rider is maximum vital requirement. The two wheeler motor cycle rider is maximum likely to preserve severe accidents throughout the injuries. The human head is very prone to injury. It's far in particular liable to acceleration/deceleration and rotational forces due to the fact it's miles freely mobile in three dimensions and occupies an exceptionally risky role, being secured only by way of the neck muscle tissues and ligaments. One of the effective countermeasures to save you head accidents in motorbike crashes is using a shielding helmet. The useful effects of helmets in direct effect are well documented and helmets have been determined to decrease the danger of head and mind injury with the aid of 70 to 88% and facial injury to the top and

mid-face with the aid of 65%. The site visitor's damage in these days identified as one of the essential health issues inside the growing countries. Visitor's injuries are most excessive and require essential care that reasons in the end excessive scientific costs and monetary losses. It could additionally reason everlasting disabilities of the sufferer. Its miles very tough to put on helmets in the countries like India because of the discomfort they precipitated in tropical climatic conditions. In step with the Indian motor car act, the carrying of motor cycle helmet is obligatory whilst riding.

Because of the pain as a result of the present day helmets, human beings use to put on open face helmet which doesn't deliver more safety to the pinnacle and the face of the rider while as compared to full face helmets. Therefore there may be a vital requirement of motor cycle helmet with accurate thermal comfort, visibility, protection and adjustable indoors head farm. The right air flow is an vital criterion for the safety and the consolation of the rider as the rider uncovered to the high flow of air, there need to be right warmth switch and air float an excellent helmet makes driving a bike greater a laugh, because of the consolation component. It cuts down on wind noise on ears, windblast on face and eyes, and to comfort from converting climate situations and reduces rider fatigue. The PCM is packed right into a pouch and located a few of the helmet and the wearer head the warm temperature form the wearer head is transferred to the PCM by means of manner of conduction via a warm temperature collector this is unfold over the wearer head no electric strength deliver is needed for cooling gadget. The temperature on the wearer head is maintained just above the PCM temperature therefore the wearer would not be afflicted by an uncomfortable and perilous hot surrounding on the top so as to have an effect on the wearer alertness.

The helmet has essential protecting components: a thin, outer shell manufactured from acrylonitrile butadiene styrene (ABS) plastic, fiberglass or Kevlar and a gentle, thick, internal liner about one-inch thickness typically made of multiplied polystyrene foam or increased polypropylene foam. The froth liner may be very just like that utilized in refrigerators as thermal insulation. A helmet cooling gadget makes use of phase change segment/fabric (PCM) to soak up all the warm temperature generated from the pinnacle at an

especially consistent temperature to provide cooling of the pinnacle and hence, the interior is maintained at a sure cooled temperature of the PCM and creates electric electricity supply. The PCM is enclosed in a pouch and positioned among the pinnacle and the helmet at the same time as the top pores and skin temperature is above the melting temperature of the PCM, the PCM starts off evolved to soften as it absorbs the heat from the top. A PCM cooled device may be applied in any shape of safety helmet. The PCM cooled gadget is good for any sort of safety helmet due to its easy shape and operation without requiring a electricity deliver. The design and structure of protection helmets can also vary in line with their supposed utilization as an instance, a protection helmet used by motorcyclist and race car drivers and a protection helmet used by introduction internet site on line people may be quite extraordinary in their systems in spite of their distinctive structures, the ones helmets require an incredible cooling machine. The PCM cooled helmet might be appropriate for the ones protection helmets. In this paper, the layout implementation of a helmet cooling machine the usage of PCM is investigated. The PCM cooled device is designed for the motorcycle helmets having short riding duration as about 2.10h. after that, the sorted warmth from the PCM may should be discharged to the ambient air for approximately 13-25 min before the helmet can be used all over again a few sensible solutions can be applied to sit back the top.

The popular and marketable techniques are the air cooled machine using air blower or vents a few cooling structures are liquid to cool the air blowing into the helmet. In a few air cooled device, the air duct is installed to the chin bar of the helmet. Such design is meant for simplest the race automobile drivers. The air cooling structures use vents to allow the herbal air glide to bypass through the indoors of the helmet to get rid of warm temperature even through those designs can be used for motorbike riders. It is controversial whether those structures are suitable for tropical nations which have excessive ambient temperatures. A helmet is a form of defensive gear worm to defend head from injuries. Helmets are used for amusement sports and sports activities e.g. Jockeys in horse riding, soccer, ice hockey, cricket, baseball, hulling and mountaineering risky artwork sports e.g. Production, mining, rise up police and transportation e.g., bike helmets and bicycle helmets till 1990s maximum helmets are crafted from resin or plastic, which may be bolstered with fibers want from ventilation in helmet has been the need of the hour for various fields have a look at has been achieved at the air go with the floe off bicycle helmets we've that intuitively critical factors which include vent pass segment or uncovered scalp floor are often restrained in their effect by using exclusive parameters. This and wide variability in helmet average performance imply that suboptimal mixtures of relevant elements lessen the sir drift of maximum helmets under the conditions studied.

II. LITERATURE SURVEY

Chippie, B. Heads., 1987[1], Helmets and warmth avenue rider mag projected that temperature in the helmet during such conditions reaches 38°C in this temperature its far very

hazardous to travel because of a reduction in the ability to pay attention therefore, retaining a bike rider cool for the duration of transit has been at the leading edge of helmet layout concerns.

Tan et al, 1998[2], had proposed the conceptual layout of PCM-cooled helmet. Theoretically, the effective use of PCM has amazing ability for cooling a helmet but to in addition develop the concept, it's far vital to perceive the elements that could impact the PCM cooling in this utility. It pursuits to perceive experimentally the influence of the simulated solar radiation, wind speed, and heat generation rate at the PCM cooling technique.

Clark, R.P., Toy, N [3], He had compelled around human head and calculated the forces which acts while sporting the helmet. The experimental investigation taking place where evaluation of the forces are calculated. Many previous study researchers made helmet cooling with the use of segment exchange fabric and through the usage of solar panels, through the usage of thermoelectric generation the characteristic of phase change material is to save cold thermal energy in night as cold facet and it is used to reduce temperature of thermoelectric module in day duration. The segment trade materials used to cool the inner of the helmet.

Tan and Fok[4], designed PCM-cooled helmet gadget by way of the use thermal resistance networks with consideration of PCM layer as one node with constant temperature of melting.

Fok et al[5], studies their experimental research on the cooling of a motorbike helmet with PCM n-octadecane which has melting point around 30°C and concluded that the PCM embedded helmet take an extended time to exceed the thermal consolation region compared to the ordinary helmet and head warmth generation turned into the primary element which shorten the cooling time.

Empa and St. Gallen [6], (2005): that they had done experimental paintings at the precept of bicycle helmet ventilation. A thermal head form setup in a climate-regulated wind tunnel became used to take a look at the ventilation efficiency of 24 bicycle helmet in wind tunnel with 6km/hr and 22km/hr at 0° and 30°, they had used compelled convection technique to transfer from head to environment they'd investigated the jobs of vents in a bicycle helmet, test without vents and blocking off the vents. The wide variability in helmet performance indicated the mixture of applicable factors reduces the air flow of maximum helmet. They had located that distinction in warmth transfer a few of the helmet of up to 10% face and 30% scalp.

III. PHASE CHANGE SUBSTANCE / PCM

A phase change substance/PCM is a substance which releases and absorbs sufficient energy at section transition to offer useful heat cooling. Commonly the transition might be from one of the first two essential stated of depend – strong and liquid – to the alternative. The segment transition may also be between non-classical stays of count number. Which include the conformity of crystals, where the material is

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going fro, conforming to crystalline structure to conforming to some other, which may be a better or decrease electricity country, the electricity launched absorbed by way f segment transition from stable to liquid, or vice versa, the warmth of fusion is typically a great deal higher than the realistic warmth ice as an example, requires 333.55J/g to soften, however then water will upward thrust one diploma further with addition of simply 4.18J/g Water/ice is therefore a totally useful phase change material and has been used to shop wintry weather cold to cool buildings in summer season considering the fact that at least the time of Achaemenid Empire.



Fig.1. Phase change substance.

A. Types of PCM

There are two types of PCM materials are:

Stable/Liquid phase change materials: In deciding on phase alternate materials the primary segment alternate of interest is the stable/liquid phase exchange. This are really divided into four categories:

1. Eutectics [-65°C to 0°C]
2. Salt hydrates [7°C to 117°C]
3. Organic substances [1°C to 167°C]
4. High temperature salts [105°C to 885°C]

Liquid/gasoline phase change materials: Liquid gas phase changes contain massive adjustments in volume or pressure whilst going from liquid to the gaseous section which prevent powerful encapsulation so these are generally now practicable for most strength storage applications.

B. Packages of PCM

1. Transportation
2. Motors
3. Creation Materials
4. Catering
5. Electronics

IV. PCM SELECTION

The head skin temperature of the wearer is designed to hold at around range of 19°C-39°C, the PCM, salt hydrates, which has the maximum operating temperature of 60°C is selected. The salt hydrate is one type of the PCM. It has quite high garage capacity consistent with unit extent and isn't flammable. It is also relatively cheaper and broadly available inside the market. The sealed pouch stores the PCM in each stable and liquid state and is designed to shorten the

discharging time (re-solidification from liquid to solid) the homes of the salt hydrate PCM are proven in desk- I.

Desk-1: Properties of PCM Series of S25&S27

S.No.	Series	Temperature of PCM (°c)	Ambient Temperature(°c)	Maximum Operating Temperature (°c)
1.	S25	25°c	38°c	60°c
2.	S27	27°c	38°c	60°c

Warmth Absorbed by PCM Series S25:

$$Q = mC\Delta T = mC(T_2 - T_1) = 0.3 \times 3.04 \times 10^3 \times (38 - 25) = 0.3 \times 3.04 \times 10^3 \times 13 = 11856 \text{ J.}$$

Conversing Impact of S25:

$$= 11856 \times 60 \div 2.372 \times 10^3 = 711360 \div 2372 = 299.89 \text{ min.} = 4.998 \text{ hrs.}$$

Warmth Absorbed by PCM Series S27:

$$Q = mC\Delta T = mC(T_2 - T_1) = 0.3 \times 3.04 \times 10^3 \times (38 - 27) = 0.3 \times 3.04 \times 10^3 \times 11 = 10032 \text{ J.}$$

Conversing Impact of S25:

$$10032 \times 60 \div 2.372 \times 10^3 = 601920 \div 2372 = 253.76 \text{ min.} = 4.221 \text{ hrs.}$$

V. DESIGN&ANALYSIS

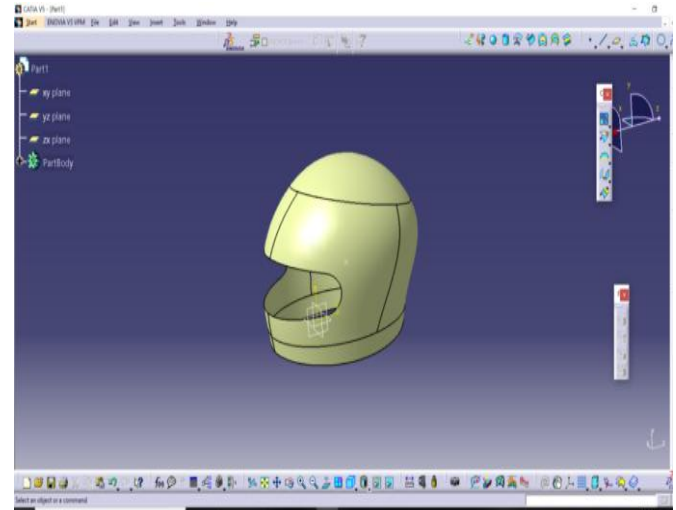


Fig3. 3-D Helmet Design with PCM.

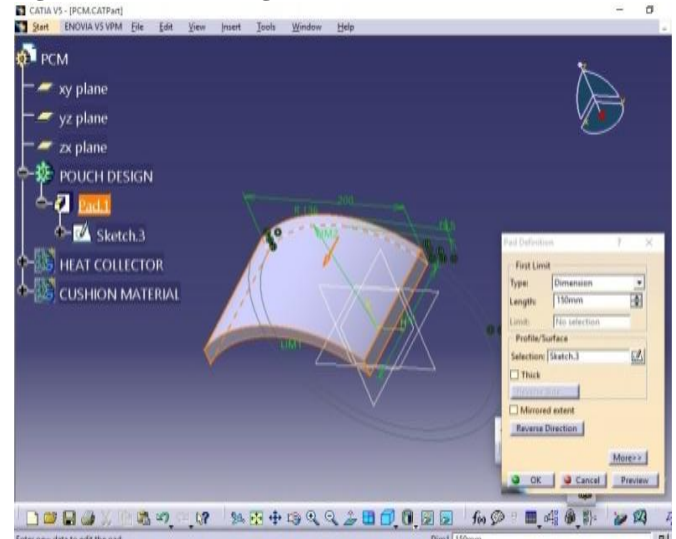


Fig3. 3-D Model of PCM.

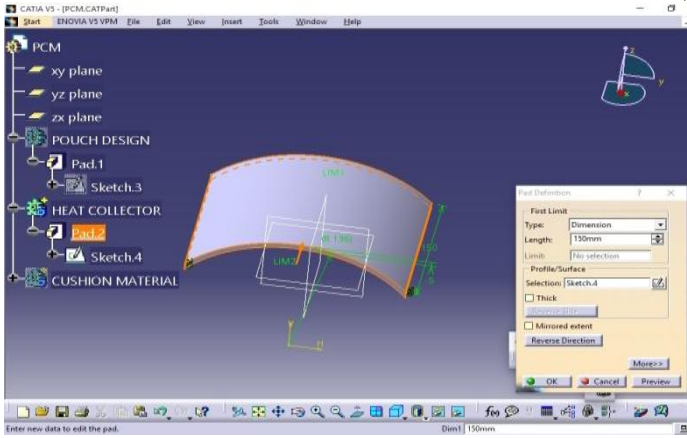


Fig4. 3-D View of Heat Collector.

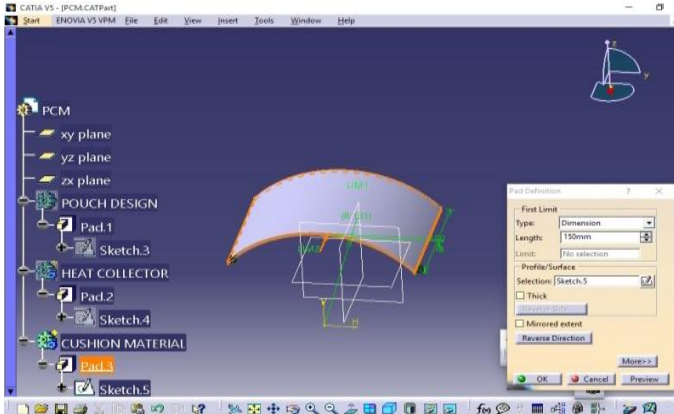


Fig5. 3-D View of Vinyl Cushion.

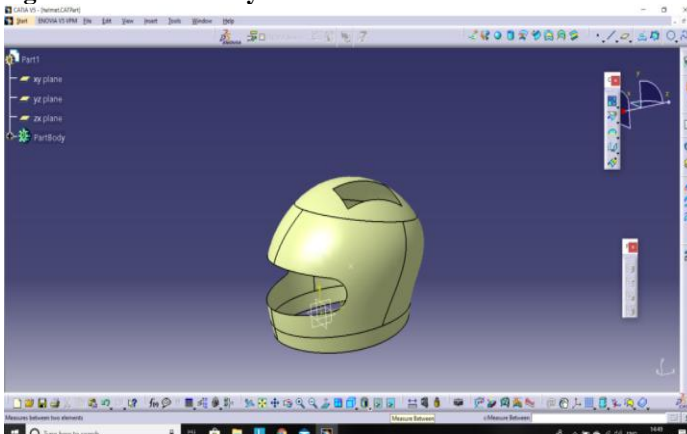


Fig6. 3-D View of Two Wheeler Helmet with Slot.

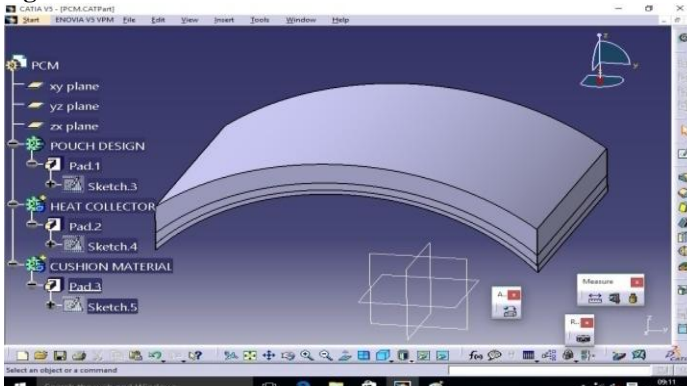


Fig7. Assemble View of Three Parts.

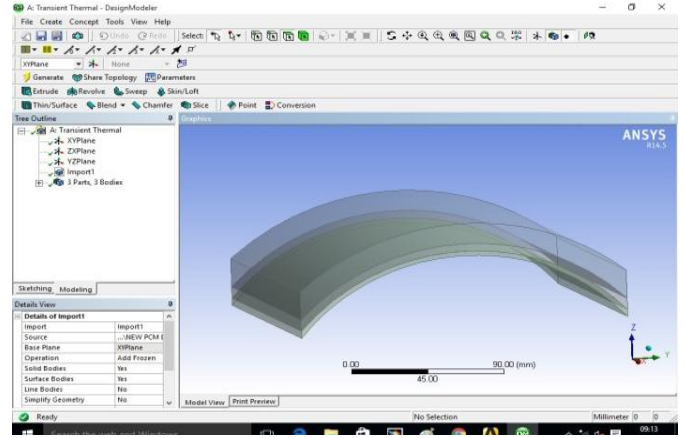


Fig8. Geometry View of PCM.

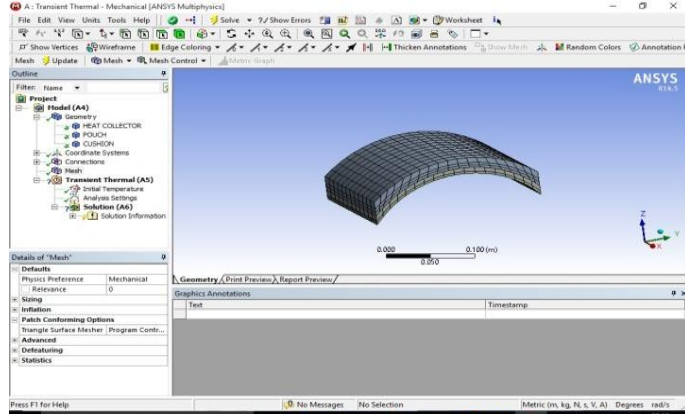


Fig9. Meshed Part of PCM.

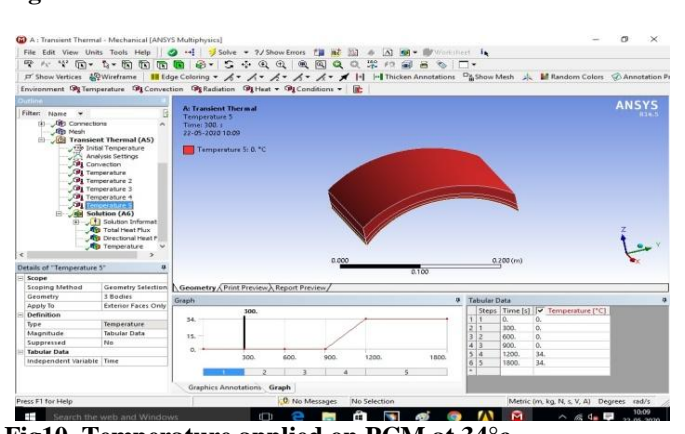


Fig10. Temperature applied on PCM at 34°C.

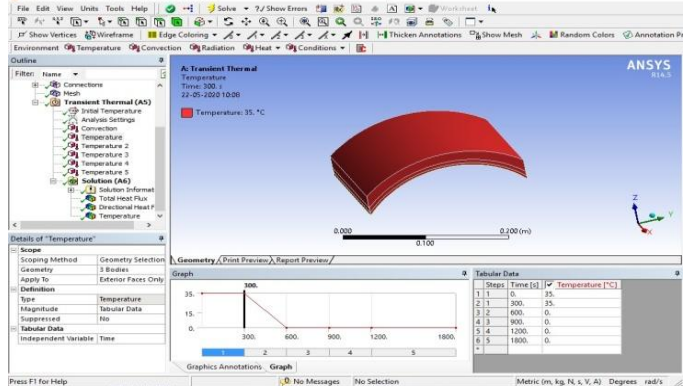


Fig11. Temperature applied on PCM at 35°C.

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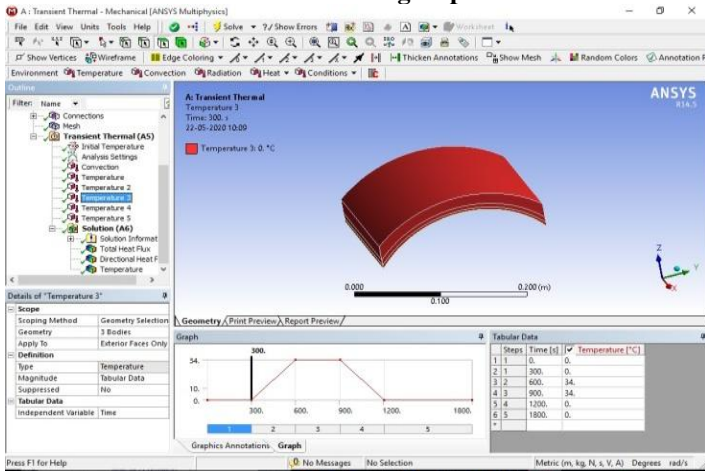


Fig12. Temperature applied on PCM at 36°C.

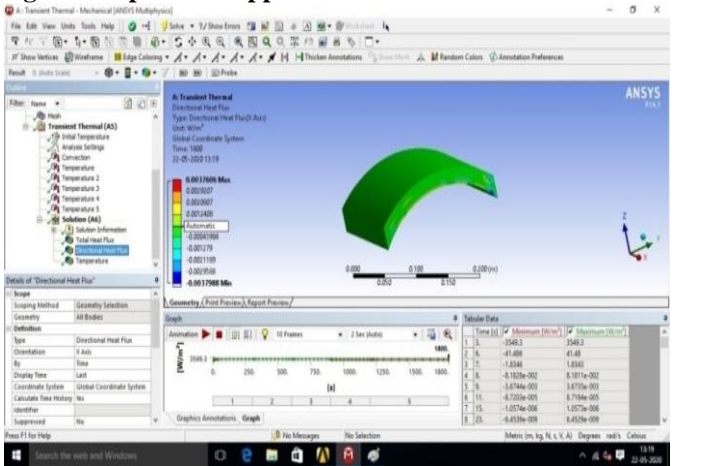


Fig13. Directional Heat Flux.

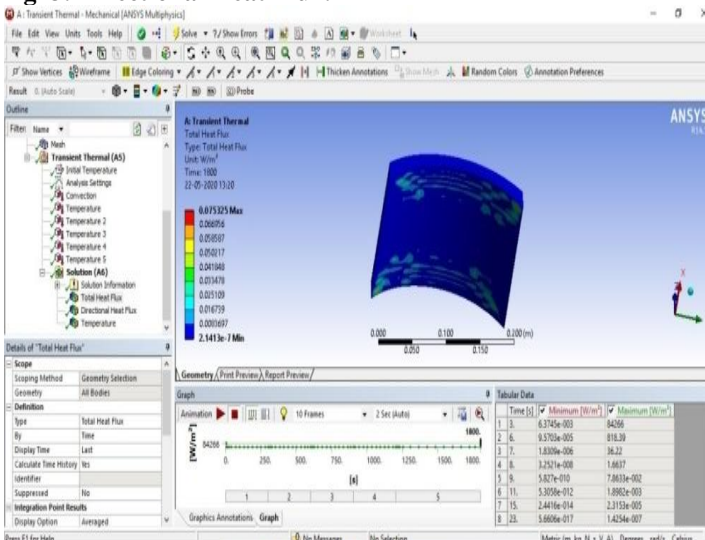


Fig14. Total Heat Flux.

VI. RESULTS AND DISCUSSION

A theoretical calculations and analysis was done for the different series of PCM employed Series that is S25 and S27 in these series the temperature with respect to time and conserving impact were noted. By Comparison of Two Materials Of PCM Series S25&S27 The Cooling Time Is More

For S25 Compare To S27 And By Analysis Comparison S25 Having Similar Values Compare To S27 . So Finally We Concluded That S25 Is having high melting temperature of 36°C and takes more time to melt of 1200sec so S25 is the Suitable PCM Series Salt hydrate for this project.

Series	Time(Sec)	Analytical Temperature (°C)		
		34°C	35°C	36°C
S25	0s	0°C	35°C	0°C
S27	600s	0°C	0°C	34°C
	1200s	34°C	0°C	0°C

VII. CONCLUSION

From the above performed project we've done design & analysis on helmet and phase change substance and we have finished suitable changes in the helmet, we're positive that the helmet will now not be a symbol of soreness however could conversely sell the riders to wear it. S25 given the cooling effect extra at the helmet for lengthy hours than S27 and its miles clean that this PCM-cooled machine can be applied in conventional helmet to offer comfort, as a result the wearer might not be afflicted by an uncomfortable and dangerous warm surroundings on the pinnacle on the way to have an effect on the wearer alertness. The PCM-cooled gadget without problems cools helmet for 4.99hrs with the best obstacle that after it gets discharged its miles to be recharged for re-use.

VIII. REFERENCES

- [1]Chippie, B. Heads., 1987, Helmets and warmth avenue rider mag projected that temperature in the helmet during such conditions reaches 38°C in this temperature it's far very hazardous to travel because of a reduction in the ability to pay attention.
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