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Design of Heat Sink and Thermal Analysis for Electronics Applications

Ramesh.T, Ramesh.V, Karthik.K

***Abstract:** The now days electronics compound very important of human life its high temperature generated during operating, it is problem take in account in this paper, so overcome this problem need to thermal management. When the increase the temperature due to reduce the compound life time. In this paper to analysis using Finite element analysis focuses on the passive cooling of electronics devices by using fin configuration, different heat flux, and materials like aluminum (6062), Copper, Tungsten to ensure lower temperature compare with maximum operating temperature, all electronic components generate heat during of their operation. To ensure best working of the electronics component, the produced heat needs to be removed using thermal management techniques. Finally more heat dissipated material with design aspect Tungsten suitable material for high input power for electronic compounds because the thermal conductivity high and low thermal gradient.*

***Keywords:** heat dissipation, electronics compound, high thermal conductivity materials.*

I.INTRODUCTION

The electronic compound working at power of 1~ 100 W and more than based on the specific applications [1]. The increased heat flux due to electrical current [2].all electronic compound produced high heat, in this problem to reduce of life time of compound, so in order to remove the heat using various techniques such round fin heat sink, forced convection [3].The finite element analysis of is very powerful approximate method, like weighted residual methods, Rayleigh Riz method. The essential target of the balance is to improve the warmth vitality move rate per unit surface region between the base surface and its convective, emanated and convective-irradiative condition. Today, because of the expanding request of elite parametric qualities yet at the equivalent time thickness in warmth bearing structures, the balances of different geometries and material properties are observed to be utilized in a wide scope of general just as jazzy designing applications which incorporate cooling, aviation, vehicle,

A. Finite Element Method

The Finite Element Method (FEM) could be a numerical powerful approximate technique to get associate degree approximate value using polynomial equation to a category of issues ruled by elliptic PDF.

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***Correspondence Author(s)**
Ramesh.T*, Mechanical, Vel Tech Rangrajan Dr.Sagunthala R&D Institute of Science and Technology, Avadi, E-mail- ramesht@veltech.edu.in
Ramesh.V, Mechanical, Vel Tech Rangrajan Dr.Sagunthala R&D Institute of Science and Technology, Avadi, E-mail- ramesht@veltech.edu.in
Karthik. K, Mechanical, Vel Tech Rangrajan Dr.Sagunthala R&D Institute of Science and Technology, Avadi, E-mail- ramesht@veltech.edu.in

FEA main objectives is are to obtain stress distribution ,temperature distribution, natural frequencies, crack progress ,enduring Strength and fatigue lifespan, vibrations, displacement. In medium scale industry the viability of a warmth sink is commonly decided to utilize numerical displaying procedures (NMT); in rather cases, hypothetical computations are utilized. In PC supported demonstrating (CAD) and reenactment, the limited FEA is perhaps the most routinely utilized numerical strategy (NM). Right now, this strategy is known as outstanding amongst other propelled building strategies because of its adaptability and strong numerical and algorithmically premise. PC programming based limited component technique is a one of a kind piece of warmth sink plan and is utilized in various phases of improvement, for an example demonstrating, execution streamlining or investigation of their qualities. Warmth vitality move is a free characteristic peculiarity yet under unmistakable conditions, it ends up unsurprising to move warmth or expel the abundance waste warmth from the hot IC surface at an upgrade rate. Warmth vitality move can be improved either by utilizing exceptionally conductive material or by rising the warmth vitality move coefficient, which may require the establishment of latent cooling warmth move frameworks like siphons or fans and so forth. Another method for upgrading the warmth move is the expansion of surface territory. Be that as it may, essentially, the material, working and geometric properties can be upgraded up to a specific point of confinement and thus the target of the vital measure of warmth evacuation turns down. In such circumstances, the option is to raise the surface zone by joining an expansion to the essential hot surface. This expansion is called expanded surface or blade.

II.MODELING ON FINED HEAT SINK

In this work design and analysis with consists of rectangular mm^2 with thickness of 5mm, height of fins 20 mm shown in figure1.The number of fins 196 with diameter of fin 3mm. The bottom side attached the IC is dimension of 20mm and 1mm thickness made of metallic material like aluminum 6062, Copper heat sink with circular Pin fins consists of 70×70,Tungsten 14 and IC made of silicone ceramic composite it has thermal conductivity is 8 W/m K . The above selected material properties and natural convention values shown in the Table 1.From the figure 2. Represent the Discretization process that called subdivide smaller convenient number of elements and assemblages it is called Meshing with element of SOLID87 for thermal analysis.

Table I: Thermal Properties for material

Material	Thermal conductivity (W /m K)	Convection coefficient (W/m^2K)	Bulk temperature (K)
Aluminum (6062)	170	40	300
Copper	400	40	300
Tungsten	1440	40	300

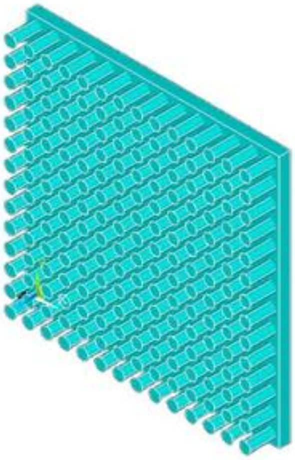

Fig. 1. Isometric view of heat sink

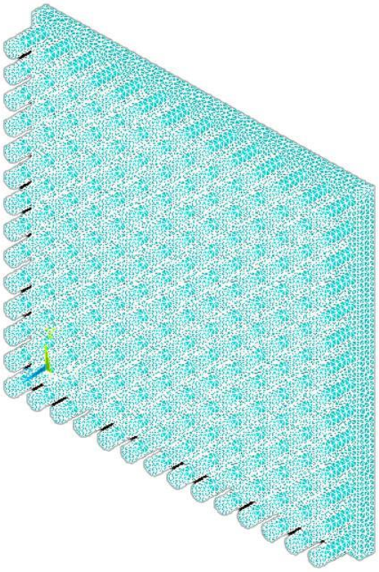

Fig. 2. Meshed heat sink

A. Boundary conditions

The fined heat sink first apply free convection on all fins face and four side of heat sink base, second surface between the IC and heat sink base apply heat flux 16000W/m^2 ,24000W/m^2, 32000W/m^2 respectively.

However bottom of IC zero heat flux applied. Free natural convection with steady state thermal analysis are followed.

III.RESULTS AND DISCUSSION

Heat transfer analysis carried out the three different and input power are 20 Watts, 30 Watts, 40 Watts are corresponding heat flux 16000 W/m^2 , 24000 W/m^2,32000 W/m^2 respectively. Shown in figure

Case 1: Aluminum (6062) with Thermal conductivity 170 (W/m K)

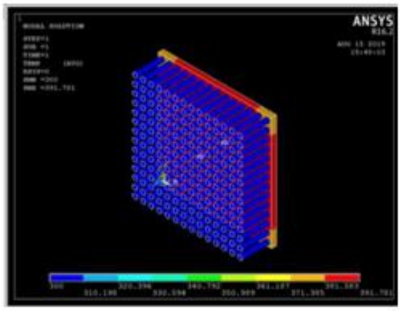

Fig. 3.Nodal Temp. at heat flux 16000 W/m^2

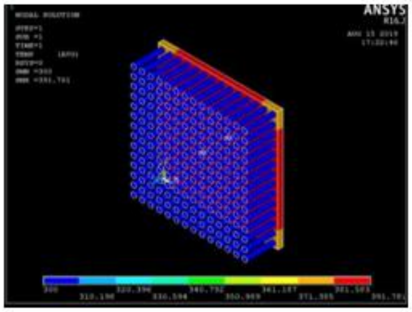

Fig. 4. Nodal Temp. at heat flux 24000 W/m^2

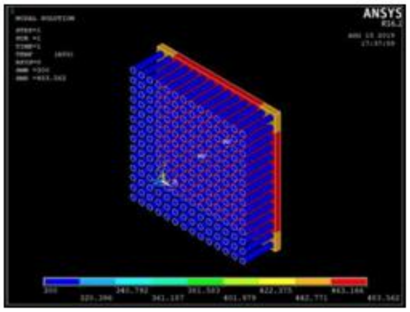

Fig. 5. Nodal Temp. at heat flux 32000 W/m^2

Case 2: Copper with Thermal conductivity 400 (W/m K)

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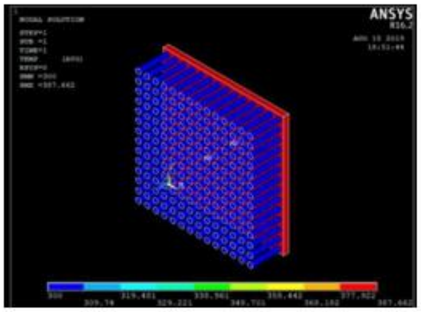

Fig. 6. Nodal Temp. at heat flux 16000 W/m^2

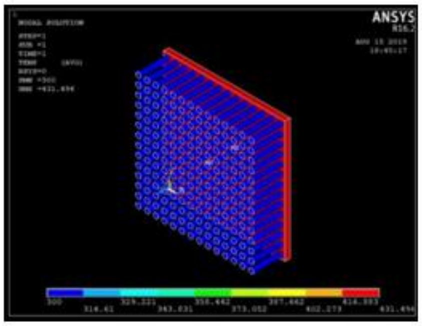

Fig. 7. Nodal Temp. at heat flux 24000 W/m^2

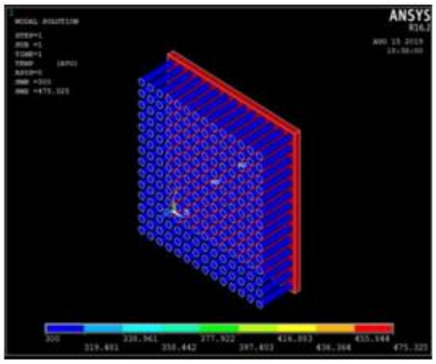

Fig. 8. Nodal Temp. at heat flux 32000 W/m^2

Case 3: Tungsten with Thermal conductivity 1440 (W/m K)

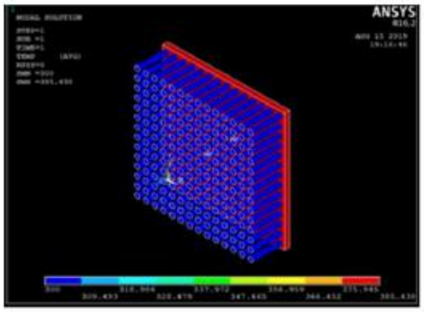

Fig. 9. Nodal Temp. at heat flux 16000 W/m^2

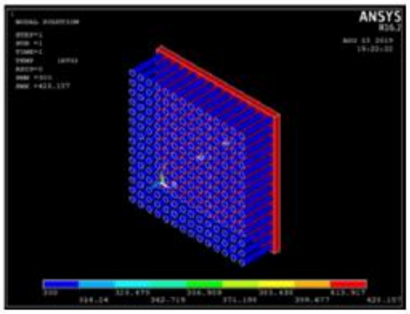

Fig. 10. Nodal Temp. at heat flux 24000 W/m^2

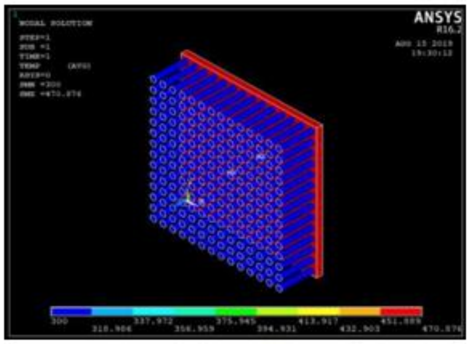

Fig. 11.Nodal Temp. at heat flux 32000 W/m^2

The Table 2 show the values of thermal gradient vector sum, nodal temperature for different materials that has been considered in the present analysis.

Table. 2

Material	Aluminium (6062)			Copper			Tungsten		
Thermal conductivity	170			400			1440		
Convection coefficient	50			50			50		
Temperature	300			300			300		
Heat flux	16,000	24,000	32,000	16,000	24,000	32,000	16,000	24,000	32,000
Nodal temp	391	391	483	387	431	475	385	428	470
Thermal gradient vector sum	1210	1210	2421	517	776	1034	144	216	228

IV.CONCLUSIONS

The present Finite element analysis using three different materials the important material properties of thermal conductivity due to change nodal temperature and thermal gradient vector sum. The analysis conclusions are discretized as following:

1. **Nodal temperature:** The aluminum material less heat dissipated because less thermal conductivity compare with Tungsten, however compare with copper significant changes for high heat flux (40 W)
2. **Thermal gradient vector sum:** The Tungsten material very less value of thermal gradient compare with aluminium. Finally conclude this study for high power electronics compound suitable for Tungsten heat sink.

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AUTHORS PROFILE

Ramesh.T, born in Tamil Nadu, India, 10th May 1985,obtanined his B.E degree in Mechanical in 2008 from Anna university, Chennai and he is currently pursing Ph.D in Vel Tech Rangarajan Technology,Avadi
Email:ramesht@veltech.edu.in

Ramesh. V is Assistant professor in Mechanical engineering from Vel Tech Rangrajan Dr.Sagunthala R&D Insitute of Science and Technology, Avadi, Chennai, India. He is research interest area of design and analysis and composite.
Email:rameshv@veltech.edu.in

Karthik. K is Assistant professor in Mechanical engineering from Vel Tech Rangrajan Dr.Sagunthala R&D Insitute of Science and Technology, Avadi, Chennai, India. He is research interest area of design and analysis and composite.
Email:karthikk@veltech.edu.in