

## Analysis and optimization of material for pin fin

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### Abstract

In the present report, the 3-dimensional CFD simulation of heat transfer and air flow in circular pin fin heat sink are presented for Electronic component cooling application. The circular pin fin heat sink are simulated for different alloys like Aluminium alloys i.e.6063-T83, 7075O (SS) and Copper alloys i.e. Chromium Copper. In this study comparing the heat transfer rate with respect to different alloys under Natural Convection. The goal of this study was to maximize the thermal performance of heat sink with respect to different material such that it helps to finding material selection, low cost material and good heat transfer rate for designing the heat sink.

Aluminium are the materials especially used rather than brass and iron. The utilization of pins in the heat sink increases the heat transfer area to reach the extreme rate of heat loss in a restricted space.

**Keywords:** aluminium, heat, sink, alloy

### Introduction

Power dissipation of electronic components are increasing and more and more electronic packages are requiring some form of thermal enhancement to adequately cool the components. One of the commonly used methods of improving thermal performance is to use heat sinks [2]. In number of applications, such as UPS, Inverter, Thermo-electric generator etc. Air flow Velocity and direction are not very well defined or controlled such application require heat sink that are not sensitive to air flow direction pin fin heat sinks are one of the types that are not sensitive to air flow direction and are widely used in electronic applications [1].

This report presents the results of a study to optimize the material of pin fin heat sink for use of electronic component cooling applications that is UPS, Thermo-electric generator etc. The goal of this study was to maximize the thermal performance [3].

It was conclude that Maximum temperature has been found out for plate fins which is 53.062 °C and Maximum Temperature is found out for Fins With circular pin fin which is 71.677 °C. Circular pin fin heat sink displayed higher heat transfer rate than the plat fin heat sink. The overall performance of the six different heat sinks with different shaped pin-fin structures was studied in this paper for different velocities varying from 5, 10 & 12 m/s. Heat sink with Rhombus prism pin fins (HS-RPPF) is found to be

more effective in dissipating heat compared to other configuration of fins [3].

The results obtained for heat sink with rectangular pin fin have been established by comparing the FEM and analytical techniques. As the number of fins were increased, the total heat transfer rate also increases

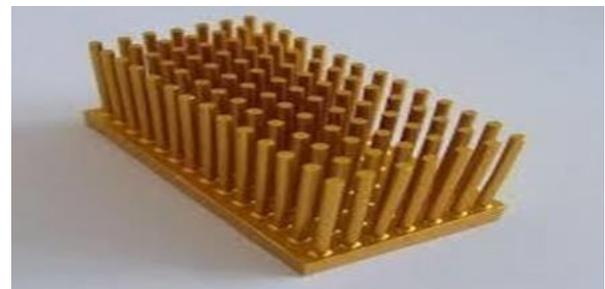


Fig 1: Aluminium pin Fin

### Literature Survey

Many of project work concentrated on design optimization of heat sink but in this study concentrated in material optimization. Materials used in this work are alluminium alloys i.e.6063 - T83, 7075-O (SS) and Copper alloys i.e. Chromium Copper. These types of materials not used in many of project work.

### Methodology

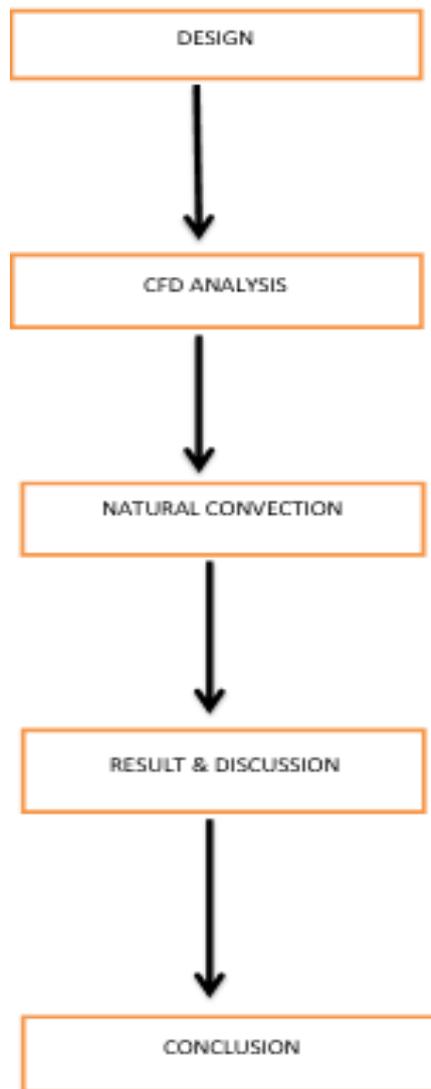


Fig 2

**Comparison of the Material**

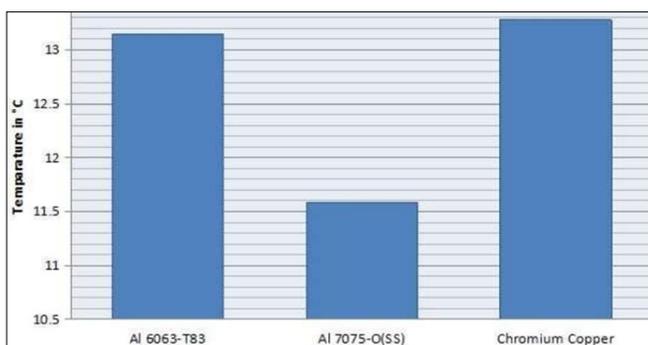


Fig 3: Temperature Comparison

**Price of the Material**

Table 1

MATERIAL	PRICE
Al 6063-T83	200 Rs
Al 7075-O	500 Rs
Chromium Copper	750 Rs

**Conclusion**

By observing CFD results, use of Circular pin fin heat sink

with material Chromium Copper is better because temperature drop is more and good heat observing capacity Compare to Al 6063-T83, and Al 7075-O alloy.

By observing, cost of material Al 6063-T83 is less compare to other two materials. Temperature drop of Al 6063 is only 0.13°C lesser than Chromium copper.

Best material for manufacturing pin fin heat sink is Al 6063T83 because low cost and light weight compare to other two materials

**Acknowledgement**

The authors are willingly thankful to all the professors and mentors who help for the preparation of this paper and would also like to thank all the reviewers, our main authors for their comments to improve the quality and presentation of paper.

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