ISSN:2348-2079

Volume-7 Issue-2

International Journal of Intellectual Advancements and Research in Engineering Computations

Experimental and investigation of AL - SI with magnesium composite material heat transfer by using PIN-FIN apparatus

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ABSTRACT

The thermal performance of an automotive radiator plays an important role in the performance of an automobile's cooling system and all other associated systems. In recent decades, the metal composite (Aluminium, Silicon and Mangnesium) radiators are being replaced by Aluminium radiators for its lower cost and lesser weight despite significant drop in performance. It has been scientifically proved that copper radiators are better than aluminium.

The Composite (Aluminium, Silicon and Mangnesium) radiator can be made more effective by modifying the geometry suitably. In this study, an attempt has been made to study the performance of a model composite plate Heat Transfer performance using PIN-FIN Apparatus.

INTRODUCTION

Copper oxide nano particles (CuO-NPs) recently raised the industry's interest due to their interesting chemical and physical properties. The continuous increase of products containing CuO-NPs and the unintentional generation of CuO-NPs by technical processes establish an increased risk of human exposure. Since nano particles can reach the brain upon exposure, it is of high interest to evaluate the uptake and potential adverse effects on brain cells. In this context astrocytes are of special interest due to their central role in the brain homeostasis and in defence processes. Radiators are involved in the enhancement of cooling progress. Commonly Radiator comprises of tubes, fin, pressure cap, transmission cooler, and inlet and outlet tank.

Generally radiator installed in front of the bumper. Air gets enter from the top or side mounted grill. In Ancient period radiator construction is made from the steel pressed plate. After the development of material science Aluminium is indulge in the construction. Plastic cover is placed at top and bottom with Aluminium tubes. **(**Aluminium, Silicon And Magnesium**)** also intends in the construction it has high thermal characteristics when compare to Al alloy.

LITERATURE SURVEY

Witry et. al.,(2003) carried out CFD analysis of fluid flow and heat transfer in patterned roll bonded aluminium radiator, in which FLUENT's segregated implicit 3-D steady solver with incompressible heat transfer is used as the tool [1].

Hilde Van Der Vyer et al. (2003) conducted a CFD simulation of a 3-D tube-in-tube heat exchanger using Star CD CFD software and made a validation test with the experimental work. The authors were fairly successful to simulate the heat transfer characteristics of the tube-in-tube heat exchanger. This has been used as the base for the procedures of CFD code validation of a heat exchanger [2].

Yiding Cao et al. (1992) introduced heat pipe in radiator. Heat pipes including two-phase closed

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thermosyphons are two-phase heat transfer devices with an effective thermal conductance hundreds of times higher than that of copper. For the terrestrial applications, gravity is often used to assistant the return of the liquid condensate and no wick structure is needed inside the heat pipe, and this type of heat pipes is often referred to as two -phase closed thermosyphons [3].

Introduction of Composites

Composite is a combination of two or more chemically distinct and insoluble phases. Constituent materials or phases must have significantly different properties for it to combine them: thus metals and plastics are not considered as composites although they have a lot of fillers and impurities

1. The properties and performance of composites are far superior to those of the constituents.
2. Composites consist of one or more discontinuous phases (reinforcement) embedded in a continuous phase (matrix)

Examples

1. Cemented carbides (WC with Co binder)
2. Rubber mixed with carbon black
3. Wood (a natural composite as distinguished from a synthesized composite)

ALUMINIUM TUBE RADIATOR

Overview of Experiment Set-up

In the experiment of performance testing of aluminium tube radiator is mounted on the engine as actual application in the testing lab, coolant is filled in the radiator. The gauges for measurement of water flow rate & air flow rate with variable value are fitted in which the value can be changed by means of circular knob as per required flow rate, temperature sensors are fitted at the inlet & outlet points of water & air both which record the inlet & outlet temperature of the water & air, pressure gauges are fitted at the inlet & outlet of air & water to record the pressure for the calculation of pressure drop. Before fitting all devices, they must be calibrated for accuracy of the experiments & results.

Fig.1 Aluminium tube

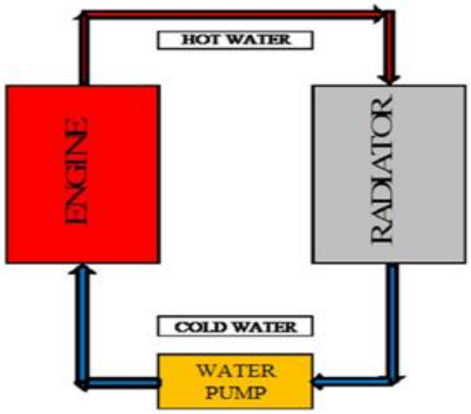

Fig.2 Circuit diagram

THERMAL ANALYSIS

In general, there are three mechanisms of heat transfer. These mechanisms are conduction, convection and radiation. Thermal analysis calculates the temperature distribution in a body due to some or all of these mechanisms. In all three mechanisms, heat energy flows from the medium with higher temperature to the medium with lower temperature. Heat transfer by conduction and convection requires the presence of an intervening medium while heat transfer by radiation does not. Mode of Heat Transfer – λ Conduction λ Convection λ Radiation

Table.1 Silicon properties

Properties	**Value**
Poisson's Ratio	0.17
Coefficient of Thermal Expansion	-0.5 (K)
Young's Modulus	150 GPa
Density	2330 kg/m^3

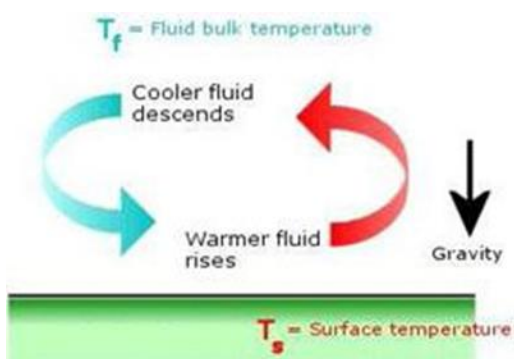

Fig.3 Convection Heat transfer

SELECTION OF MATERIALS

This chapter describes the details of processing of the composites and the experimental procedures followed for their mechanical characterization. The materials used in this work are

1. Aluminium alloy
2. Silicon carbide
3. Magnesium

Table.2 Material properties of aluminium alloy

Properties	Value
Elastic Modulus	69000 N/mm2
Poisson's Ratio	0.33
Thermal Expansions Co-efficient	2.4x10-5 /K
Thermal Conductivity	170 w/mk
Specific Heat	1300 J/kg k

APPLICATIONS

1. Automobile components
2. Corrosion resisting areas
3. Tidal power plant components.
4. Marine logistics components**.**

CONCLUSION

Micron-sized SiC particles were incorporated into a melt of aluminium with magnesium the aid of addition as a wetting agent to fabricate aluminium matrix composite. Two casting temperatures and stirring time were applied to focus on the ceramic particle incorporation, porosity formation, agglomeration of ceramic particles, and interfacial reactions between Composite materials especially aluminum and silicon composites having good mechanical properties compared with the conventional materials. It is used in various industrial application these materials having light weight along with high hardness. It with stand high load compare with the existing materials are most applicable in the engineering products instead of existing materials. Finally it was concluded that the percentage of al-si-mg increases automatically the hardness strength and heat transfer rate increased.

REFERENCES

[1]. Heat and Fluid Flow", 15, 1994, 399-409.
[2]. Levi A. Heredity in cast iron. The Iron Age 6, 1927, 960–965. 2. Frank, F.
[3]. R.L. Webb, Principles of Enhanced Heat Transfer, John Wiley & Sons, New York, 1994.
[4]. S. Sunil Kumar and S.P. Venkateshan, "Optimized Tubular Radiator with Annular Fins on a Non-Isothermal Base, Int. J.
[5]. Vertman, A. Samarin, A.; Yakobson, A. Structure of liquid eutectics. Izv. Akad. Nauk SSSR, Otd. Tekhn. Nauk. Met. Toplivo, 3, 1960, 17–21. 4.
[6]. Wilkins J.E., Jr., "Minimizing the Mass of Thin Radiating Fins", J. Aerospace Science, 27, 1960, 145-146.