Enhancement In The Natural Convection Rate of Automobile Engine By Integrating The Radiator Fins With Nanomaterial

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Abstract- *During the design and development of automobile it was a bigger challenge to avoid the engine & engine components from surplus heat produced inside the engine cylinder. Thus, a cooling system is essential to prevent seizure of the engine from melting and damages. The cooling system of an automobile portrays a critical role in vehicle's performance. Presently all automobile industries are using aluminum-based Radiator. The Traditional radiator does partial heat dissipation and does not meet the necessity at high engine output. Radiator being the major element of cooling system, improvement of it significantly leads to the overall improvement of performance and efficiency. The best and viable way to improve the radiator is by boosting its result output by modifying the fin performance.*

Keywords- Nanotechnology, Radiator, Engine performance, Efficiency, Heat dissipation

I. INTRODUCTION

The Radiator assembly comprises of following components i.e., an inlet tank, an outlet tank, and core. The core has two sections, a set of tubes and fins. Radiator core is normally made of flattened aluminum tubes with aluminum fins that zigzag between the tubes. The air and coolant of two types of working fluids are normally in engine cooling system. As the air flows through the radiator, the heat is shifted from the coolant to the air. The purpose of the air is to carry away the heat from the coolant, which in turn exits the radiator at a lesser temperature than it entered. The coolant is passed across an engine, where it engages the heat. The hot coolant is then supplied into a tank of the radiator. From the radiator tank, it is scattered across the radiator core across tubes to an additional tank on opposite side of the car radiator. As the coolant pass by all the way through the aluminum-based radiator tubes on its way to the opposite tank, it diffuses much of its heat to the tubes which, in turn, shift the heat to the fins that are lodged between each row of tubes.

The Design of a locomotive radiator poses disputes in terms of determining the best configuration for selecting the fin material, types of tubes, type of coolant and the flow rate of the coolant. Consequently, it is required to expand the total heat transfer coefficient from the frontal area of the radiator by

addition composite material fins of high thermal conductivity characteristics. Addition of fins is one of the attempts to boost the cooling rate in the radiator. It is positioned for larger heat transfer area and improves the air convective heat transfer coefficient. The existing radiator fins are restricted to aluminum, one of our method is to select a new fin material to enhance the rate of heat dissipation.

Carbon nanotubes (MWCNT) are chosen as a new material for thermal controlling in automotive radiator since it has tremendous high thermal conductivity. Thermal conductivity of MWCNT has been described to be more than 3000W/mk. The recent improvements in nanotechnology have given assurances in advancing technology used in the car radiator. The new class of composite material i.e., Al-MWCNT which shows greater thermal conductivity than the pure aluminum, with this exceptional attribute, the size and weight of an automobile radiator can be lowered without affecting its heat transfer operation.

II. LITERATURE REVIEW

Due to restricted space at the front of the engine, the radiator size is constrained and cannot be primarily increased, so that, we can rise the heat transfer coefficient from the existing radiator with nanotechnology integrated fin material i.e., Al-MWCNT.

There are study efforts to examine, convective heat transfer coefficient of automobile radiator using various fin material. Using Nanotechnology integrated fin material instead of aluminum fins on the existing radiator design, the average percentage rise of convective heat transfer is more than 10% that of the traditional radiator.

III. EXPERIMENTATION

The experimental setup of automobile radiator is used to assess the heat transfer coefficient of cooling system. This experimental setup contains automobile radiator, the reservoir steel tank, a DC power supply, An electrical heater, a centrifugal pump, rota meter, valves, a fan, thermocouples, manometer tube with water. An electrical heater (1500W) within a steel storage tank set to correspond to the engine and to heat the fluid. A voltage regulator (0–220 V) is offered for the power to keep the inlet temperature to the radiator from 45^0C to 90^0C.

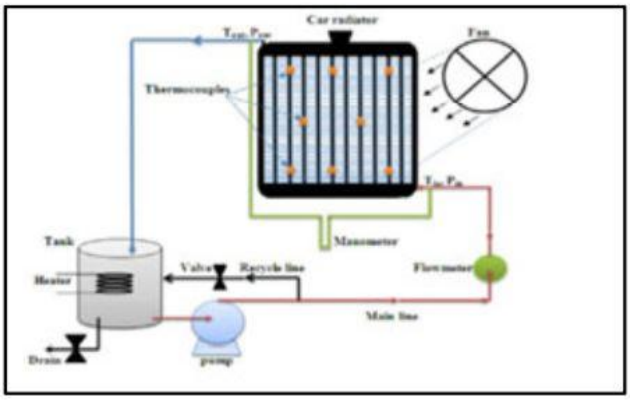

Fig: Flow diagram of Radiator

<u>Experimental data analysis</u>:

The Newton's law of cooling is used to discover the heat transfer coefficient and Nusselt number.

<u>Results and Discussion</u>:

The values of Heat Transfer Coefficient, Nusselt number, etc. were analysed from the experimental values.

Heat transfer coefficient rises with increase in mass flow rate in automobile radiator with nanotechnology integrated fins as contrasted to pure aluminium fins. It is due greater thermal conductivity of composite material.

Nusselt number rises with increase in mass flow rate in automobile radiator with nanotechnology integrated fins as contrasted to pure aluminium fins. It is due Nusselt number continually depends on heat transfer coefficient. The value of Nusselt number rises with increase in heat transfer coefficient in above said car radiator.

From the projected work, heat transfer coefficient is enhanced with rise in percentage of composite fin material used in the radiator core. About 12.26% heat transfer improvement was attained with addition of Al-MWCNT fins to existing radiator design. Use of above said composite fins in the current design, the weight of the radiator is decreased.

Inferences from Experimentation:

1. Cooling system is essential to prevent failure of the engine from melting and damages.
2. Automobile Radiator: Multiwall carbon nanotubes (MWCNT).
3. Using Nanotechnology integrated fin material instead of aluminum fins on the existing radiator design.

IV. FUTURE SCOPE

1. The radiator performs vital role in reducing the high-raised temperature of whole system. Cooling takes place because of natural convection happening through radiator surface.
2. When nano material is integrated with the fins, rate of natural convection rises noticeably.
3. Concerning the cool down demands, it is noted that integration of nano materials is the only wise choice accessible with us for use in future.
4. Herewith it is demonstrated that the coating is efficient in improving natural convection while seeing the thermal properties of carbon nano tubes, the projected degree of rise in natural convection rate is regulated and monitored by diffusion force and viscous force.

V. CONCLUSION

1. As percentage of composite fin material used in the radiator core rises, heat transfer coefficient is enhanced. About 12.26% heat transfer improvement was attained with addition of Al-MWCNT fins to existing radiator design.
2. Nanotube composite materials is very helpful for thermal management purposes.
3. While seeing the thermal properties of carbon nano tubes, coating is effective in improving natural convection. Diffusion force and viscous force regulates and monitors the anticipated degree of rise in natural convection rate.

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