

EXPERIMENTAL STUDY ON THERMAL PERFORMANCE OF CLOSED LOOP PULSATING HEAT PIPE (CLPHP) WITH VARIOUS WORKING FLUID AND FILLING RATIO



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A thesis Submitted by the Department of Mechanical Engineering in partial.
Fulfillment of the Requirement
For the degree of B.Sc. in Mechanical Engineering (ME)

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September – 2022

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Submitted to the

**DEPARTMENT OF MECHANICAL ENGINEERING
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BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING

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ABSTRACT

With the advancement of science and engineering the need for space restricted cooling devices has increased. Closed loop pulsating heat pipe (CLPHP) is a new promising technology for heat transfer of microelectronics. In it by simple mechanism heat is transferred effectively and efficiently. The combination of processes like bubble nucleation, collapse, formation of vapor plugs and slugs, agglomeration, dynamic instabilities and temperature/pressure perturbation, etc. leads to exceptional heat transfer capability of the heat pipe. The aim of this research paper is to better understand the operation of PHP through experimental investigations and obtain comparative results for different parameters. A series of experiments are conducted on a closed loop PHP (CLPHP) with 4 loops made of copper capillary tube of 2-3 mm inner diameter. The heat pipe structure is using normal, CLPHP. Propanol, Ethanol, Butanol & Acetone is taken as the working fluid. The operating characteristics are studied for the variation of heat input, filling ratio (FR) and orientation. The different filling ratios are 20%, 60%, 80% and working fluid are Propanol, Ethanol, Butanol And Acetone based on its total volume. The orientations are 0° (vertical). This paper attempts to demonstrate the effect of variation of different parameters on the same structure as well as the variation of thermal performance depending on the presence of wire insert and fins on different structures. The experiment demonstrates the effect of filling ratio and inclination angle and structural variation on the performance, operational stability and heat transfer capability of Propanol, Ethanol, Butanol & Acetone as working fluid of CLPHP. Important insight of the operational characteristics of CLPHP is obtained and optimum performance of CLPHP using propanol, ethanol, butanol & acetone is thus identified. Propanol, Ethanol, Butanol & Acetone work best at 20%,60%,80% FR at wide range of heat inputs for all structures of CLPHP. The best performance is obtained with normal structures. The optimum performance of the device can be obtained at vertical position

APPROVAL

This is to certify that the project on “(EXPERIMENTAL STUDY ON THERMAL PERFORMANCE OF CLOSED LOOP PULSATING HEAT PIPE (CLPHP) WITH VARIOUS WORKING FLUID AND FILLING RATIO)” submitted by(**Md. Masud Rana Mozumdar, ID No: BME1901017659, Md. Mehedy Hasan, ID No: BME1901017637, Md. Aslam Kabir, ID No: BME1901017343, Mahim Ahammed, ID No: BME 1802015102,**) has been carried out under our supervision. The project has been carried out in fulfillment of the requirements for the degree of Bachelor of Science (B.Sc.) in Mechanical Engineering of year of 2022 and has been approved as to its style and Contents.

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DECLARATION

We, hereby, declare that the work presented in this project is the outcome of the investigations & research work performed by us under the supervision of **MD. SOJIB KAISAR** Assistant Professor, Department of Mechanical Engineering, Sonargaon University (SU) Dhaka. We also declare that no part of this project thereof has been or it being submitted elsewhere for the award of any degree.

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