HEAT ENERGY STORAGE BY USING PARAFFIN COMPOSITE AS PHASE CHANGE MATERIAL AND APPLIED IN HEAT EXCHANGERS

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This work presents the thermal performance in a phase change heat storage unit. Paraffin wax mixed with cuprous oxide as phase change material (PCM) is filled in the heat exchangers. Generally the paraffin wax having the high thermal conducting property so the paraffin mixed with cuprous have withstand the more temperature. Shape-stabilized phase change materials (PCMs) exhibit desirable thermal storage properties and are used for energy conservation systems. This project is focused on the preparation and thermal/dynamic-mechanical properties of the bulk porous CUO_2 impregnated with Organic PCMs such as paraffin's .The results indicated that the new shape-stabilized PCMs composites could be produced by a simple method. The PCM composite is generally having the high thermal conductivity so this mixture is generally mixed in the ratio of 8:2. So we can get the good results by mixing the 80% of paraffin wax with the 20% of the cuprous oxide.
Keywords*: performance, paraffin composites, heat exchanges, cuprous oxide, thermal conductivity*

I. INTRODUCTION

Energy consumption has drastically increased in recent years due to very rapid development of the economy and human society. Consequently, a lot of greenhouse gases, such as carbon dioxide, are emitted into atmosphere, which consequently contributes to the global warming. Therefore, there arises an issue of improving energy efficiency so as to decrease the energy consumption. Thermal energy storage is an effective way to balance the mismatch of the energy supply and energy demand; furthermore, renewable energy resources through energy storage can also be integrated into the energy system to make it more sustainable. There are in general three kinds of thermal energy storage methods, i.e., sensible heat storage, latent heat storage and chemical heat storage. Latent heat storage is considered to be effective and advantageous due to its large heat storage capacity by involving the latent heat of fusion and constant temperature during phase change. So far, latent heat storage has been widely utilized in many applications, such as solar energy system, electricity peak-shaving and industrial waste-heat recovery. On the other side, the characteristic of constant temperature during phase change can also be used to realize the temperature control, which is very important and essential in such cases as electronic cooling and thermal management. The heat transfer characteristics are very essential in determining the thermo-fluidic performance of the energy system with phase change material as the heat transfer medium. However, the low thermal conductivity of phase change material always hampers its heat transfer performance, which requests that the thermal conductivity must be enhanced.

Phase changing materials

Paraffin is a widely used PCM with a thermal conductivity of about 0.2-0.4 W/(m K). As a result, many researches have been conducted to find appropriate methods to enhance the thermal conductivity of the phase change material. The widely used methods include adding high thermal conductivity matrix into PCM, installing fins on the wall of heat exchanger, encapsulation of PCM and fabricating PCM composites. Among these methods, using metal foam as the thermal conductivity enhancer has been applied in various applications due to its abundant pores, which allows for a good fluidity of liquid PCM and large specific contact surface area between PCM and ligament of metal foam. Here we just mention a few typical recent results about the thermal conductivity enhancement by using metal foam and the investigation of the heat transfer characteristics. CUO_2 fabricated the composite PCMs using several metal foams and paraffin, and the measurement of thermal conductivities of the composite PCMs indicated that the thermal conductivity could be dramatically enhanced. For example, the thermal conductivities of the paraffin/copper foam composite with the porosity of 88.89% and pore size of 25 PPI was about forty-four times larger than that of pure paraffin.

Table 1. Melting point of PCM components.

Sr.	Materials	Melting point
1	Paraffin wax	40 ^{0}C
2	Aluminum oxide	2072 ^{0}C
3	Cuprous oxide	1326 ^{0}C
4	Zirconium di oxide	2715 ^{0}C
5	Sodium oxide	1132 ^{0}C

II. OBJECTIVE OF THE PROJECT

[1] To increase the thermal conductivity of the paraffin by adding cuprous oxide.

[2] To reduce the more heat and store more heat on the paraffin composite.

[3] To know about the paraffin and cuprous composite.

[4] To reduce the malfunction of the heat exchanger and to reduce energy loss.

III. METHODOLOGY

The paraffin is having very low melting point and it is mixed with the cuprous oxide and to form the composites. The composites are mixed with the help of the magnetic stirrer and heater apparatus, the paraffin composite is having the high thermal conductivity and high melting point. So the cuprous oxide is selected where it is mixed with the paraffin wax to give the high thermal conductive components.

IV. EXPRIENMENTAL SETUP

The experimental model setup is made up with the copper tube and the heat exchangers are made with the copper plate, the helical coil heat exchanger is taken for the experiment. The heat exchangers are filled with the prepared paraffin composites and it will be sealed with the help of welding process. when high pressured steam is passed in to the heat exchangers it will release the heat to the paraffin composites which were filled in to the heat exchangers. The water bath is present above the heat exchangers to conduct the heat stored from the paraffin composites.

V. FIGURES

Fig:1. Heat exchanger setup

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Fig.2: inside view of heat exchanger with paraffin

VI. RESULT:

Table 2: the experimental calculations

S.NO	TIME TAKEN IN(MIN)	TEMPERATURE T1°C Inlet temprature	TEMPERATURE T2°C Paraffim composite	TEMPERATURE T3°C Outlet temprature
1	0(no flow)	130	32	30
2	2	130	37	125
3	4	128	38	124
4	6	127	38	122
5	8	126	39	121

VII. REFERENCE

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