

Phase Change Materials Using Solar Water

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Abstract: Sun is the source of solar energy. So the solar energy from the sun at all times energy should be stored and used when needed. Solar energy is important one renewable energy resources. The solar energy is the renewable energy it regenerated in day by day. So the using solar energy initial cost only. The solar energy it used for heating, coking purpose and electricity generation. The recent days using for phase change materials for storage the thermal energy in solar water heaters for domestic purposes during night time. This is for efficient way for storing and trapping solar energy. The application of phase change materials in cooling and heating and systems is to improve overall efficiency, reduce electrical power consumption and greenhouse gas emission. The heat storage unit consisting of phase change materials (paraffin wax).The water heater functions normally hot water supplies during the day. The storage unit stores the heat to phase change materials during the day supplies hot water during the night. Thermal energy lost by the system can be reducing by different type of systems integrate with phase change materials into solar collector, hot water tank, duct, heat exchanger technology and due to system efficiency increases. This study helps to developing a new advancement experimental setup of solar water heating system with phase change materials.

Keywords- phase change materials, paraffin wax, water heater and hot water.

I. INTRODUCTION

In now a days people are moving the in renewable energy .The main reason is demand of electricity increased due to increasing in population. The fossil fuel, thermal, hydro power production not present nearer area so transmission cost and transmission losses are more. To digress the transmission losses it used for renewable energy resources. The unit cost of energy obtained from renewable energy resources is more than expensive than non-renewable energy resources. The research have of used on decreasing the investment and operating cost of these source. The solar energy is one of the most important renewable energy resources and is converted to electrical energy through photo voltaic (PV) modules (4). The using for

phase change materials using solar water heater when comparing to using electric heater it is quick heating, time saving and more efficient. Phase change materials using solar water heating systems are very simple using only sunlight to heat water (3). The phase change from solid to liquid is preferred because of the operating pressure is lower than liquid to gas or solid to gas phase change (1). The storing solar energy with help of phase Change materials. Utilizing of this energy to heat the water for domestic purposes during night time. The system consist of two absorbing unit one is the solar water heater and another one is the heat storage unit consisting of phase change materials. The phase change materials is consist of paraffin wax. During day time the solar heat collectors are absorb the heat from sun light and the phase change materials is heated with the help of solar radiation. The phase change materials is transfer it heat to the water. Phase change material as absorbing heat we can get the hot water during night time (2).

II. ENERGY STORAGE METHODS

The energy available for various forms. According to the law of conservation of energy the energy can neither be created nor be destroyed it can only be converted from one form of energy to another useful form of energy.

The main parts of the block diagram (Figure.1)

1. Water storage tank,
2. Control valve,
3. Solar panel,
4. Voltage booster,
5. PCM,

A. Water storage tank:

Water storage tank it used for storing the water. The used for two type storage tank one is the cold water storage tank and another one is hot water storage tank. The two tank are inter connected with pipe and also connected with one control valve. The control valve will be open the cold water flow on to the water heating tank. The water will be heated to given output for hot water.

B. Control valve:

The Control valve is used for to control the flow of water. The generally used for hot water in morning time are night time. The necessary of using in hot water to open for Control valve one. The Control valve one is open to flow of cold water in phase change materials fixed tank. The phase change materials

is already heated with solar power. So the heat transfer with phase change materials to cold water. so the water will heated Control valve two is open two given hot water.

C. Solar panel:

The Solar panel is generate electricity in directly in to a sun light. The solar energy is renewable energy so it create day by day. The solar panel it generate electricity used for to heat the phase change materials. solar panel it generate electricity on (12v,3w).

D. Voltage booster:

The Voltage booster it used for to boost up the voltage on 12 volt to 50 volt. So it impure the efficiency of the water heating system.

E. PCM:

A phase change materials (PCM) is a substance with a high heat of fusion. In which, melting and solidifying at a certain of temperature, is capable of storing and releasing large amounts of heat energy. The selection of a phase change materials for a particular application in based on a careful study to the properties of the substances since there is no such material present which all the properties to become an ideal phase change materials.

The phase change material classified on four type solid – solid, solid – liquid , solid – gas and liquid to gas. The using for phase change materials in solid – liquid this is also two type fatty acid and paraffin. The paraffin is most suitable for phase change materials.

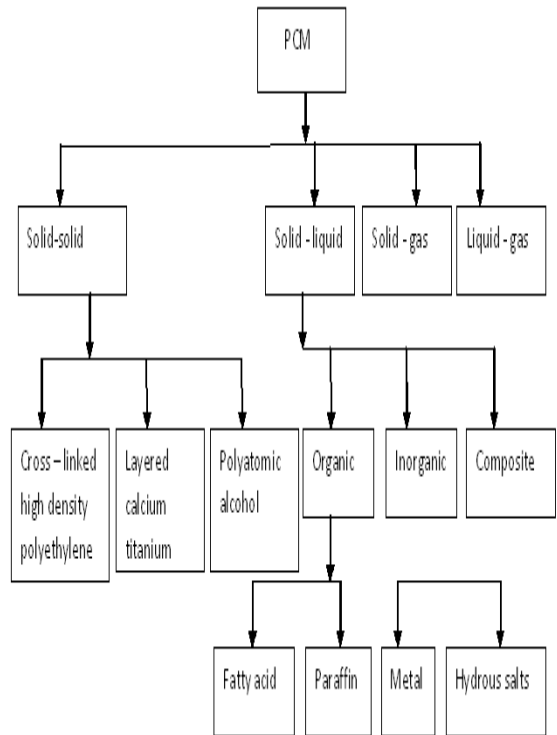


Fig.2. Classification of PCM

F. Paraffin wax:

One of the most reliable phase change materials is paraffin wax .which are being extensively used reason days as heat storage material in most of the thermal storage unit is paraffin wax. Paraffin wax a heat storage material. Which is the material heated with Pelletier. The properties such as large thermal and heat characteristics present in paraffin wax the thermal characteristics of paraffin wax are changing phase change temperature low pressure in molten state and self-nucleating behavior. The paraffin wax used as phase change materials in their thermal heat energy storage unit. Paraffin wax is a mixed of long chain of n- alkanes [CH₃-(CH₂)-CH₃]. Properties like melting point and heat of fusion increases as the length of chain also the length of chain. Example: pentadecane, hexadecane and tetradecane etc.

Merits:

1. Self nucleation,
2. More heat of fusion,
3. It is chemically stable,
4. They can be recycled,
5. Segregation is absent.

Demerits:

1. They are flammable,
2. The low solid state thermal conductivity,
3. During freezing cycle more heat transfer is required,
4. To required for special contaminants to raise the burning temperatures,
5. Volumetric latent heat storage capacity is less

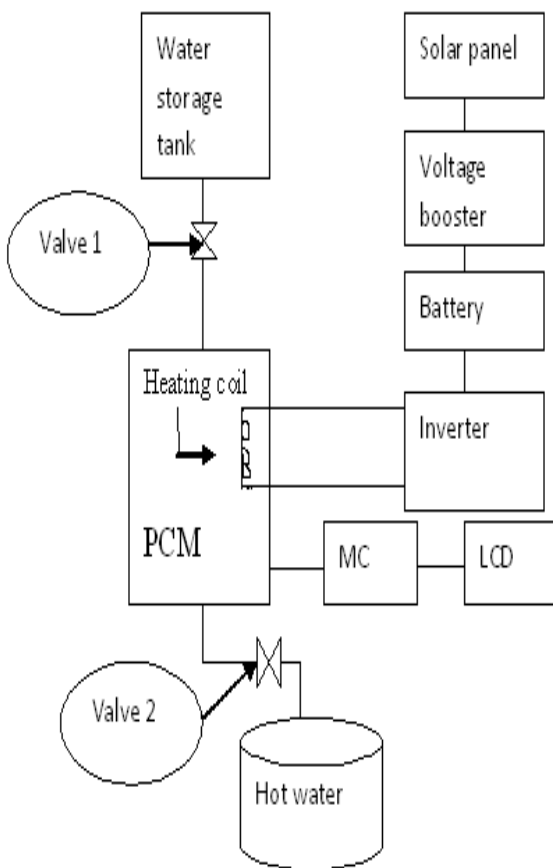


Fig.1.Block Diagram of PCM based Solar Heater

Table 1: Some Paraffin and properties

Paraffin	Freezing point (°C)	Heat of fusion (KJ/Kg)
5838	47-50	189
6499	66-68	189
P116	45-48	210
6403	62-64	189

F. Microcontroller

The microcontroller it used for to check the temperature level for the water. The microcontroller to send the signal to the LCD display. The microcontroller used in AVR family and pin number is ATMEGA328.

F. LCD

The LCD it used for to monitor the temperature level to the water. The used for the LCD size is 16 x 12. Alphanumeric displays are used in the wide range of applications, photocopiers, word processors, medical instruments, cellular phones, point of sale terminals, cellular phones, including palmtop computers, etc. The 16 x 2 intelligent alphanumeric dot matrix display is capable of display 224 different symbols and characters. A full list of the symbols and characters is printed on pages 7/8 (note these symbols can vary between brand of LCD used). This booklet provides all the technical specification for connecting the unit, which requires a single power supply (+5V). Available as an optional extra is the Serial LCD Firmware, which allows serial control of display. This option provides a much easier connections and use of the LCD module. The firmware enables microcontrollers (microcontroller based system such as the PICAXE) to visually output user instructions onto an LCD module. The all LCD commands are transmit serially via a single microcontroller pin. The firmware can also be connected to serial port of a computer.

III. WORKING PROCEDURE OF HARDWARE MODULE

The water stored in the cold water storage tank and it passed to the Phase change materials placed tank (fig.2). The solar energy is the source of the Phase change materials using solar water heater. The solar energy it generate electricity in (12 volt, 3watts). The 12 volt power it heat with the Phase change materials to spend the time is more. So the water quickly heated in boost up to the voltage in solar panel. So it using for on voltage booster in 12 volt to 50. So the efficiency improving on over all system on voltage booster. The boosted voltage is send to the voltage in Phase change materials so the material is heated during day time. The heat will be stored in Phase change materials. The necessary of using to the hot water in morning time or night time. The storage water tank is store the cold water. The necessary to use a hot water to open the control valve one so the gold water is transfer in water storage tank to Phase change materials placed tank. The Phase change materials is already heat for day time with using for solar panel. The water will be heated send the signal to microcontroller. The microcontroller is connected with LCD display.



Fig.3. Hardware Setup

The LCD display to display the heat level of water. It used for monitor the water heating in any time. The water will be heated to open the control valve two so the get the hot water.

CONCLUSION

In this project complete focus was given on the study about how the use of PCM enhances the thermal energy storage and all the various applications. There is tremendous progress in the field of thermal energy storage but still there is scope of further advancement in this field.

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