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LITERATURE REVIEW ON ENERGY STORAGE MATERIALS

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Abstract - *The main objective is to study about the Phase change materials (PCM) are ideal products for thermal management solutions. In fact, they store and release thermal energy during the melting and freezing process (transition from one phase to another). When said material freezes, it releases large amounts of energy as latent heat of fusion or crystallization energy. On the contrary, when the material melts, an equal amount of energy is absorbed by the immediate environment as it passes from solid to liquid.*

Key Words: *PCMs (Phase Change Materials).*

1. INTRODUCTION a phase change material (PCM) is a substance with a high heat of fusion which, when melted and solidified at a certain temperature, is capable of storing and releasing large amounts of energy. The heat is absorbed or released as the material passes from solid to liquid and vice versa; therefore, PCMs are classified as latent heat storage units (LHS).There are many types of phase change materials, typically capable of switching between a minimum of two physical states. They are used in many different commercial applications where energy storage is required and, therefore, the physical properties of materials are measured and recorded for comparison purposes.

1.1 Background And Motivation A comfortable home with minimal heat consumption is the modern dream of men, governments and researchers. Energy consumption for mechanical cooling paperwork is a primary percentage in the residential and industrial sectors and fashion indicates the percentage of ultra-modern cooling energy of buildings in the domestic sector. The use of the new mechanical cooling requires complex cooling structures that consume high quality electricity. This proportion is expected to increase at destination with an increase in thermal demand for a boom proportional to industrial demand. The reduction in electricity supply for the construction of refrigeration systems requires advanced technology per hour, which can be executed in different ways.

1.2 Applications

- Cold energy battery
- Cooling of heat and electrical engines
- Thermal energy storage
- Waste heat recovery
- Passive storage in bioclimatic building
- Thermal comfort in vehicles

1.3 Advantages

- Freeze without too much cooling
- Ability to blend congruently
- Compatibility with conventional building materials
- Chemically stable

2. LITERATURE SURVEY

Tumirah et al. [1] Manufactured in n-octadecane nanocapsules characterized as organic MCP (phase change materials) for TES (thermal energy storage) for its physicochemical and thermal properties. The nanoencapsulated organic PCM was prepared by encapsulating n-octadecane as a core with a St (styrene) -MMA (methyl methacrylate) copolymer shell using a miniemulsion in situ polymerization process. The author has carried out a detailed study on the influence of St / MMA and the n-octadecane / copolymer mass ratio in the encapsulation processes, the physicochemical and thermal properties of the nanocapsules obtained. It also analyzes the increase in stability, chemical and thermal reactivity, which depends mainly on the perfect morphology; Smooth and compact surface and spherical shape of nanoparticles with an average diameter of 102 nm. The document revealed that the n-octadecane in the form of nanocapsules melts at 29.50 ° C and crystallizes at 24.60 ° C using a differential scanning calorimeter (DSC). The results of the experiment show that the N-octadecane nanocapsules have an enthalpy of 107.9 and 104.9 Jg-1 for the fusion and crystallization combinations for construction applications that is chemically stable.

Huanzhi Zhang et al. [2] prepared multifunctional composite films through a thermosetting process using polyvinyl chloride (PVC) as a film matrix, encapsulated micro-PCM (micro-PCM) as temperature control additives and TiO_2 nanoparticles (nano-TiO_2) as UV blocking additive. SEM was used for the homogeneous dispersion of micro-PCM and nano-TiO_2 in the PVC matrix. The latent heat and thermal conductivity of the film made with 6% by weight of micro-PCM and 6% by weight of nano-TiO_2 = 8.96 J / g and 0.2356 W /mK. The author revealed a change in the phase change temperature and latent heat of films made after 100 thermal cycles. The temperature of a space surrounded by the film made with 6% by weight of micro-PCM sand

and 6% by weight of nano-TiO2 can be controlled in a range of 25 to 28 ° C for 3298, guaranteeing applications in buildings and cars energetically efficient.

Sayyar et al. [3] investigated the fatty acid-based phase change material (PCM) supported by interconnected graphite nano-sheets to form a stable nano-PCM compound incorporated into gypsum board using a sandwich structure. Citric acid (AC) and palmitic acid (PA) were added to interconnected graphite nano-sheets for the preparation of nanocomposites of fatty acids. The morphologies of the interconnected graphite and nano-PCM layers were studied using a scanning electron microscope (SEM) using the LaB6 emitter. The dynamic scanning calorimeter was used for melting temperature, freezing temperature and latent heat of CA-PA and nano-PCM. A sandwich wall panel was designed to incorporate CA-PA nanocomposite into drywall. The author has developed numerical models to extrapolate these experimental results to evaluate the actual energy savings (heating / cooling) by incorporating nano-PCM into the building envelope (test cell). The paper revealed that a 79% reduction in energy demand to keep the interior in the range of thermal comfort and the temperature time achieved were altered by the application of nano PCM.

Aziz et al. [4] manufactured new PCM-based compounds stably using one-shot electrolytic spinning. In this study, nanocomposite nanofibre was prepared by considering polyethylene glycol (PEG) as a phase change material and polyamide 6 and various nanoparticles (SiO_2, Al_2O_3, Fe_2O_3 and ZnO) as supports. It has been reported that fiber diameter decreases with increasing nanoparticle loading. The diameter of the fiber depends largely on the electrical conductivity of the solutions. The minimum average diameter of the fibers was found to be 59 nm for the Fe-4 compound. Of all the compounds tested, the starting temperature for the SiO2 compounds was the highest, while the Al-1 compound had the maximum maximum temperature. The compensation temperature in the ZnO compounds tends to be independent of the mass percentage of the particles. The author reported that, compared to pure PEG, the Zn-1 compound exhibited a faster rate of heat transfer with nanoparticles. There was 41.75% increased thermal conductivity in Al-4 compared to pure PEG. The material is suitable for construction applications for storing thermal energy.

Pisello et al. [5] studied morphology, optical characteristics, thermal characteristics, electrical properties and deformation detection capability of cement-based compounds doped with different carbon nanoinsidencies, namely MWCNT, CNF, CB and GNP. The author also pointed out that all carbon nanoincludes would reduce solar reflectance while producing negligible variations in thermal emission. Thermal conductivity and diffusivity were increased with nano-platelets of graphene and a better distribution of thermal waves. Consistently, the same graphene samples produce the highest electrical conductivity and capacitance. Excellent deformation detection capabilities for cement-based compounds with multi-walled carbon nanotubes, although their contributions to electrical conductivity are less important.

Yaojie Tang et al. [6] prepared binary eutectic myristic-stearic acid (MA-SA) with an appropriate phase change temperature. The melting point of the eutectic MA-SA and the mass fraction of the AM in the eutectic mixtures are 42,700 C and 54%. Then, a series of MA-SA / CNT was synthesized with different mass fractions of CNT (3%, 6%, 9%, 12% and 15%) in order to examine the thermal properties of the CPCM (material change in composite phase). The minimum mass fraction of the CNTs (carbon nanotubes) in the CPCM was 9%. The latent heat of the CPCM decreases with the increase of the content of the CNT. The author pointed out that the degree of super cooling of the CPCM decreased with the addition of the CNT. The results of the TCM test showed that, compared to the thermal conductivities of the eutectic MA-SA, the thermal conductivities of the CPCMs increased by 23.2%, 49.4% and 63.7% in the solid state and by 15, 6%, 32.0% and 39.7%. % in the liquid state since the mass fractions of the CNTs is 9%, 12% and 15%. However, since the thermal conductivity is high, the latent heat is lower; the appropriate relationship between the CPCM and the practical applications has to be further developed. Based on the calculated and experimental results, the GMM model can be used to calculate the thermal conductivity values of MCP composed of CNTs. On the basis of all the above results, CNTs are not only the nucleating agent, but also the promoter of thermal conductivity of CPCM in building systems.

Kalaiselvam et al. [7] studied the heat transfer characteristics by phase change and the thermal behavior of the MCP spherically encapsulated in pure form and with dispersed nanoparticles. An experimental analysis and an analytical evaluation were performed in which alumina and aluminum nanoparticles were incorporated into pure PCM. With NPCM, the solidification time has been reduced. For 60% of n-tetrad cane with aluminum nanoparticles, the reduction in solidification time was 12.97%, while for 40% of n-hexadecane with alumina nanoparticles, 4.97%. It has been reported that the rate of fusion improves with the nanoparticles in the MCPs and that, with the reduction of the size of the nanoparticles, energy transport increases. Micro convection effects were induced in the PCM nanoparticle mixture, which improved the general mechanism of heat transfer under freezing and melting conditions. This affects the loading and unloading periods of the PCM to improve the thermal performance of the LTES system.

G. Sukhorukova (8) This article presents the construction and properties of a new type of design capsules with an approximate dimension of 10 nm to µm and a dimension in nm of the wall. They are prepared by consecutive adsorption of oppositely charged polyelectrolytes on a colloidal particle which is then sacrificed. Thanks to an appropriate choice of materials and conditions, the properties, in their special permeability and mechanical module, can be adjusted and modified. This can be used in enzymatic synthesis in microvolumes, as well as to produce gels sensitive to internal stimuli. Thanks to the composition gradients designed through the wall, a photoinduced vector electron transfer can be realized. Due to its modularity and versatility, the system is a platform for many applications in medicine, pharmacy, biotechnology, food technology, cosmetics or detergents.

Yasushi Yamagishi (9) for cold energy applications, the viability of the microencapsulated phase change material (MCP) and its suspension has been studied experimentally. Thermal properties, rheological properties, and structural integrity of microcapsules (MC) in PCM were evaluated. Two types of paraffin, n-tetradecane and n-dodecane (melting point 5.5, -13.5 / spl deg / C), were microencapsulated in PCM. MC samples of four different size distributions ranging from 5 / spl mu / m to 1000 / spl mu / m were prepared for this work. PCM micro-condensation in supercooling induced by the smallness of MC was detected by differential scanning calorimetry (DSC) and heating / cooling temperature variations of the suspension. The structural stability of PM depends on their diameters. The smaller MCs withstood the suspension flow constraint and volumetric expansion of the phase change. The suspension containing a high concentration of small MC had a high apparent viscosity. Ionic surfactants were effective additives for reducing viscosity. The significant reduction in the friction of the suspension was observed due to the turbulent reduction of the resistance during the pressure drop measurements.

3. Scope for further research

In general, PCMs have thermal properties such as latent heat, capacity, thermal conductivity, melting and freezing time, etc. to beautify the thermal houses. The nanoparticles are dispersed in PCM with varying proportions and study the thermal characteristics of the nonmaterial. Due to the growing demand for energy due to population growth, it is essential to conserve and redistribute energy for proper use. PCMs are generally used to meet the cooling needs of the growing energy demand. But PCM is lagging behind with thermal residences such as latent heat, melting and freezing times. To improve these homes, nanoparticles are incorporated and PCMs are also used to meet energy needs.

4. CONCLUSION

To finding the sizes of nanoparticles within the range. SEM results should be reveled about the nanoparticles, they shapes and volume ratios. Finding out the DSC results, with variation in the melting and freezing points with significant increase in latent heat of PCMs.

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