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Application of Combined Materials for Baby Incubator

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Abstract

Incorporation of phase change materials for the development of a system to store the latent heat belongs to the most functional technique to store thermal energy with a popularity of the storage process being isothermal in nature and surplus of high-energy storage density. The concept of maintaining the temperature suitable for the babies to incubate and therefore controlling the fundamentals parameter necessary with the help of phase change materials is the vital objective of this research. The objective of the creation of microenvironment for babies is accomplished by the combination of PCMs, thermal energy storage devices, thermal insulators. Thus, the development of PCM into nano-HVAC components developed phase change thermal energy storage baby incubator. Phase Change Materials exhibit peculiar applications in the storage of thermal latent heat systems for the control in thermal applications of spacecrafts, solar engineering and heat pumps. The objective of this research is manufacturing of a cost effective and portable baby incubators to make the babies sustain in adverse environmental conditions specially in the tribal regions where medical aid and hospital and health care facilities are not available at the vicinity.

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Keywords: PCM; Baby Incubator; Thermal Energy storage; Thermal Insulators;

1. Introduction

The present-day research focuses on the development of novel renewable energy sources. Development of storage devices are presently considered yet another need for innovation along with the development of new sources of energy. Challenges relating to the storage and conversion of energy in a conventionally suitable form to avoid its depletion have been faced in the present-day scenario by the technologists and researchers. The most potential source of energy is the solar radiations which are used in its direct form. Efforts are constantly concentrated in

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increasing the efficiency and effectiveness in the usage of renewable energy sources with the ever-increasing emissions of greenhouse gases and increase in the prices of fuels.

Increasing the performance of the energy consumed and simultaneously promoting the usage of renewable energy sources are essential to neutralize the gap between storage and consumption of energy. In the past, few years, the issue related to the storage of energy to maximize the usage of renewable energy sources by making it available at all periods of time was addressed as the key objective to the research community. Reviewing their work, it can be sought to a conclusion that most of the researchers summed up their work towards the application of phase change materials. Capacity and reliability of the device used for the storage of energy play an imperative role while decoding the method to store the energy produced. Deriving from the issue of the efficiency and performance of energy storage, it addresses the usage of thermal insulators and storage devices. The advances of thermal insulators have been exclusively studied in countries like Germany, Scotland and Japan where the issues relating to the health hazards due to environmental pollution have become an introspecting factor for the researchers to look forward to. Redemption of convention or exhaustible fuels leads to lowered capital investment and as well as reduced wastage of energy by incorporating energy storage methods. Incubation of the phase change materials are ascetic and efficient techniques to store thermal energy.

To make PCM materials available for the mentioned purposes, it is important to study the manufacturing techniques to produce them. Many researchers have tried to establish the relationship between the input machining parameters and the quality of the machined surface. However, very few literature is available which correlates the quality of the machined phase change materials with its performance. J. L. Li et al. [1] observed that the simulation of ASB (adiabatic shear band) and episodic fracture were carried at dissimilar cutting speeds for determining the primary reason for the formation of saw tooth chip during machining with uncoated carbide inserts of Nimonic C 263. Many researchers carried out the machining of NIMONIC alloys. M.V.R.D. Prasad et al. [2] revealed that the surface roughness is primarily governed by the feed rate with the help of ANN approach. S. Yadav et al. [3] analyzed the undercut in SS304 material with the technique of photochemical machining in which minimum undercut (Uc) was observed at the temperature of 45 °C, etchant concentration 650 gm/litre and etching time 90 minutes. Bin Zou et al. [4] studied nickel based super alloy wiz NiCr2OTiAl while exploring for the damages caused at the surface during turning operation for various feed rate, depth of cut and cutting speed. It was observed that, at 0.15 mm/rev of feed rate with 1 mm depth of cut and 100m/min cutting speed, good surface finish is obtained with less work-hardening layer, also lower cutting forces are generated. S. Yadav et al. [5] observed experimentally orthogonal micro-machined surface features and chip morphology of AISI1215 steel by EBSD method in which it was concluded that the chip segment per unit length show several segments reduced as the rake angle increases for all the four work materials that were heat treated at the various temperatures. X. D. Guo et al. [6] and P. Subhash et al. [7] found that the feed rate and the depth of cut have more influence on topography of the surface along with the residual stress. A. Saraf et al. [8][9] made use of collimated light beams while exposing the image, controlling the intensity of light beams during exposing, avoiding the undercuts in etching by controlling etch rate, controlling the thickness of photoresist over the substrate, properly aligning the photo tool with substrate, using ultrathin foils etc. and manufactured fine features and also stainless steel was considered as the elements for such applications as its mechanical properties and biocompatibility in human body. Danish Khan et al. [10] investigated that the feed rate was the most important aspect to determine surface roughness.

2. Experimental work- Selection of Material

The experimental work of this research involves the selection of proper combination of thermal insulators, thermal energy storage material and phase change material, and that are capable to maintain the temperature, humidity, oxygen and breathing gas filtration. For this it becomes necessary that the materials selected for alloying are non-toxic, non-corrosive and sustainability of these materials in the naked environment. It has been observed that most of the phase change materials resemble melting point which is either below 0°C or above 90°C. Figure 1 shows the classification of different energy methods and are elaborated below.