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"THERMAL & MECHANICAL PROPERTIES OF BANANA FIBER REINFORCED EPOXY RESIN COMPOSITES ADDED WITH FLY ASH":REVIEW

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Abstract - *Materials based on natural fibers are now becoming more famous as thermal insulating material. Due to its light weight, density and cell structure, they show quite good thermal insulation properties, which is more advantageous over synthetic fibers. A great benefit of the insulation property based on natural fibers is not only a low value of thermal conductivity but also the natural character of these fibers.*

Thermal insulation is the reduction of heat transfer between objects with different temperatures. When the density of the material decreased, it reduces the solid conduction. The actual conductivity in the solid will not change, but the cross section area of the solid material will affect the solid conduction per square meter.

Key Words: Thermal Insulation, Thickness, conductivity etc.

1. INTRODUCTION

The improvement of thermal stability in natural fiber-reinforced polymer composites has great concern in advanced materials. There is lot work done on improvement in thermal properties still, the natural fiber-reinforced polymer composites are being investigated to advance their thermal resistant properties by using nanoparticles, fire retardants and naturally thermal resistant lignocellulose fibers.

Some of researchers did their work are explained as follows:

Thermal properties like thermal conductivity, thermal resistance, thermal insulation, etc. are important in many textile applications such as apparel, blankets, and sleeping bags, interlinings, building insulation, automobiles, aircraft and industrial process equipment [1].

In fact, these thermal properties are fundamental to determine the heat transfer through fabrics [2].

The thermal property of fabric material is very important for both its thermal comfort and protection against changing weather conditions [3].

The different types of textile materials those are generally used as thermal insulation media are mostly in nonwoven, woven and knitted forms etc. Thermal conductivity of needled nonwoven structures can be predicted with high accuracy using model with fabric thickness, porosity and structure along with applied temperature. as was investigated by Mohammadi et al. [4].

Jirsak et al. concluded that thermal conductivity decreases with increasing material density [5]. Morris et al. concluded that when two fabrics have same thicknesses but different densities, fabric with lower density shows greater thermal insulation [6].

Abdel-Rehim et al. studied heat transfer through different fabrics made by polypropylene and polyester mass it's ranging from 400 to 800 g/m2 and they concluded that the investigated fabrics have high thermal performance and thermal response as insulators [7].

Saleh et al. investigated properties of needled lining produced from polyester, cotton and recycled fiber and concluded that fabric thickness, mass and fiber type affect the thermal properties of the fabric [8].

In the same study the compressed linings show lower thermal insulation properties compared with non-compressed which was explained by a possible amount of trapped air of non-compressed nonwoven lining which provides greater thermal insulation. The calendaring process gives a more compact structure of nonwoven fabrics, thus resulting in a controlled and predictable compressibility. With calendaring needled polypropylene nonwoven fabrics the range of porosity becomes narrow when the characteristic opening sizes is reduced [9].

The influence of the calendaring process of polypropylene nonwoven geotextiles on water permeability under different loads, as well as pore characteristics have been recently investigated and it has been concluded that additional bonding with calendaring needled polypropylene nonwoven geotextiles provides a more controlled and predictable performance considering only needled geotextiles [10].

Debnath and Madhusoothanan have studied thermal resistance and air permeability of needle punched nonwoven fabric made from jute and polypropylene blends to observe the effect of fabric weight, needling density and blend proportion on thickness, thermal resistance, specific thermal resistance, air permeability and sectional air permeability [11].

They concluded that thermal resistance and thickness increase but air permeability and sectional air permeability decrease significantly with the increase in fabric weight at all levels of jute contents [12].

The reclaimed fiber based non-woven materials, suitable for automotive application, was studied were authors founded that thermal conductivity of reclaimed fiber-based nonwoven materials varies significantly, depending on the type of reclaimed fibers and the resulting bulk density of the materials [13].

Determination of heat transfer by radiation in woven and nonwoven fabrics was investigated were authors concluded that nonwoven fabrics showed substantially higher increase of thermal conductivity with temperature than woven fabrics due to strong free convection effects caused by high temperature drop between the layers [14].

Nonwoven fabrics produced from polypropylene fibers are used in industry as thermal insulators. By development of its applications there is a need for thermal insulators of lower thickness. Matusiak and Sikorski investigated the influence of cotton woven fabrics of different weaves, linear densities of the weft and different weft densities on their thermal insulation properties. They observed that both the weave of the fabric and linear density of weft yarn significantly influence the thermal conductivity and thermal resistance of the woven fabrics. The highest thermal conductivity and least thermal resistance were noted for plain fabrics. They concluded that that the thermal conductivity of woven fabrics made of the same material (fibers) depends on the specific mass of the fabrics while the thermal resistance of the fabrics depends only on its thickness and is directly proportional to it. They also observed that the linear density of weft yarn also influences the thermal conductivity of the fabrics. Results obtained from several studies carried out over the years, show that it is possible to shape the thermal insulation properties of woven fabrics by changing the density of their structure, the yarn linear density or yarn density. Changing the fabric weave without altering other parameters (such as the kind of yarn and yarn density) also enables significant changes in the thermal insulation properties of woven fabrics. Matusiak and Sikorski also investigated the correlation between the thermal insulation properties of fabrics and their cover factor and found that this is weaker than that between the thermal insulation properties and structural factors taking into consideration the weave of the fabrics [15].

E Onofrei et al. investigated the influence of knitted fabrics structure on the thermal properties of the fabrics. From the results obtained, they concluded that the thermal property is influenced by both raw material type and knitted structure parameters. In their detailed study, they pointed out that the thermal conductivity is in a great extent influenced not only by the yarn characteristics, but also by the fabric structure. They concluded that the thermal management performance of the studied fabric specimens is greatly affected by raw material properties, which significantly increased or decreased the values of the different comfort related properties [2].

Tiwari M. [16] stated that clothing system must be able to control inward and outward flow of heat to maintain body temperature to avoid serious hazard to body.

Slater K. [17] summarized that heat transfer between human and surrounding environment together with the movement of moisture constitutes the major thermal comfort maintaining mechanism. The resistance offered by fabric to the movement of heat through it is important to maintain its thermal comfort.

Slater K. [17] also stated that the total thermal resistance to transfer of heat from the body to the surrounding has three effective components which are resistance to heat transfer from the material surface to surrounding, thermal resistance of clothing material itself and thermal resistance of the air trapped inside the fabric. Nonwovens have large number of air voids entrapped inside the fabric structure thereby giving better barrier against heat flow.

Choi et al [18] concluded that nonwoven widely accepted as protective garment in medical and industrial areas due to enhanced and tailor-made thermal and comfort properties.

3. CONCLUSIONS

- Improvement in thermal properties of natural composites.
- Determination of optimum volume fraction of fiber.
- Feasible for use in automobile for weight reduction.

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