GRADIENT OF TEMPERATURE IN COMPOSITE OF FIBER OF COCO-LATEX

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ABSTRACT

Given the unquestionable need of environmental preservation, the natural fibers have been seen as a salutary alternative for production of composites in substitution to the synthetic fibers, vitreous and metallic. In this work, the behavior of a composite was analyzed done with fiber of the peel of the coconut as reinforcement and latex as head office, when submitted the source of heat. The temperature profiles were verified in the internal surfaces and it expresses of the composite as well as the temperature gradient in the same. It was also analyzed the behavior of this composite when submitted to a cold source. Consequently, with respect to the responses of the system, conclusions were reached.

Keywords: natural fiber, composite, temperature, latex, gradient.

INTRODUCTION

The great majority of the applications of thermal isolation in systems domestic, commercial and you elaborate in the drop strip and average temperature (up to 110ºC), it is made being used aggressive materials to the nature such a mainly as: glass wool, rock wool, polyurethane, polystyrene among others. Such materials, in spite of the effectiveness in the retention of the flow of thermal energy, besides they have considered cost, when discarded they are long years for they be absorbed by the nature.

Then, trying to adapt to a world politics concerning the preservation of the environment, a study began with the intention of growing up an insulating one thermal composed of natural materials and that are more accessible to the bio-degradation. For this, it was chosen as main matter source the coconut it excels (cocus nucifera linn), an abundant fruit in the Brazilian Northeast, whose coating (exocarpo) it is rich in natural fibers and when discarded little taken advantage of, inducing a low cost and I lower joined value., where she opted to use these fibers as reinforcement of the composite to be used as insulating thermal.

THEORY

As material for analysis, the fiber of the coconut was used (cocus nucifera linn) in the state dry, natural, of the municipal district of São José de Mipibú-RN/Brasil. The fibers had the diameter and the length that oscillated among 0.3 to 0.6 millimeters and 150 to 230 millimeters, respectively. The retreat of the fibers of the peel and your cleaning were made manually (Mendes, 2000). Used for the formation of the composite, a natural material was also used–that was the latex, natural of the state of the acre - Brazil. Later, the fibers were interlaced giving form to a blanket where the latex was inserted for the formation of the thermal insulating composite. The figures 1, 2 and 3 show the aspects of the traverse section of the fiber and of the thermal composite, respectively.

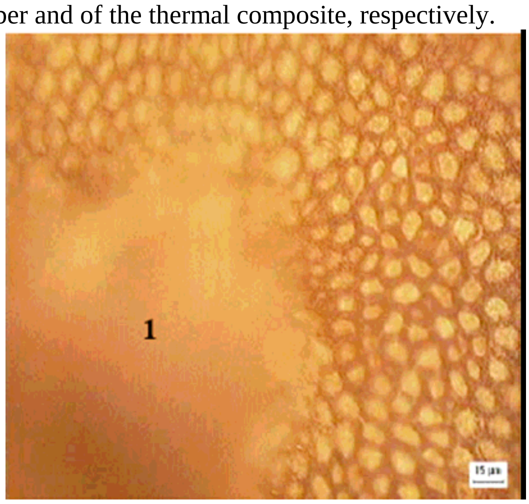

Figure 1. Transverse section of the fiber of the coconut (optic500x) 1 - central emptiness.

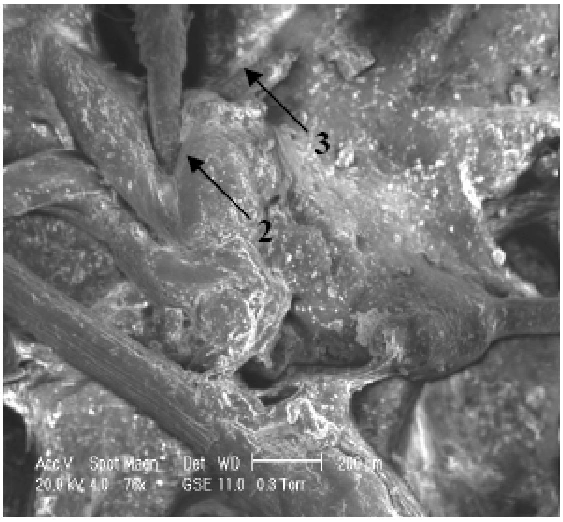

Figure 2. Composite (electronic 76x) 2-latex. 3-fiber.

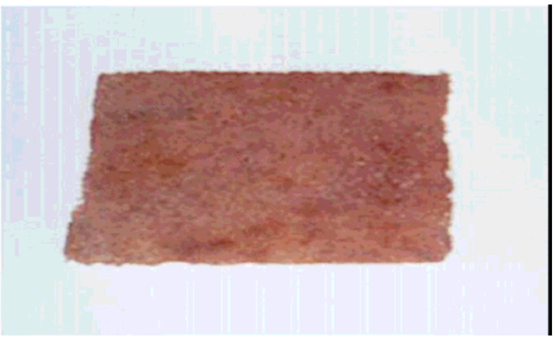

Figure 3. Thermal Insulating composite.

EXPERIMENTS

- Resistance to the flow of heat in hot systems

The great temperature variation through the mass of the material characterizes the gradient of temperature of this material, which is associated with the resistance of this material to the flow of heat. For analyses of this property a source of heat was used in a circular pin of steel carbon 1020 with 20 diameter mm, 120 length mm and a source of potency of 110 watts. Involving the warm circular pin was placed the thermal composite of fiber and latex of 20 mm of thickness. Interfered three termopares of copper-constantan (type T) in the composite being a located one in the interface composite circular pin, other to 10 mm of distance of the surface of the pin and other in the surface it expresses of the composite. The termopares were connected the a plate of acquisition of data of 16 channels that was connected the a computer through which the temperature curves x time was traced. The experiment was executed in agreement with the norm ASTM C-518-76.

- Resistance to the flow of heat in cold systems

The behavior of the thermal insulating composite natural in cold systems was analyzed in a tunnel of wind with 140 cm of length, traverse section of entrance of 50 cm x 25 cm and section of test of 25 cm x 25 cm. The experiments were led being placed inside the tunnel capsules of aluminum with external diameter of 28,5 mm, external diameter of 22,5 mm and height of 82,5 mm, with internal volume of 26,8 cm^3, where inside which a block of ice existed whose temperature was monitored by termopares type T inserted through a hole in the cover of the capsule. The termopares were connected the a plate of acquisition of data with sixteen channels, which was connected to a computer. The capsules of aluminum were submitted the a flow of air with speed of 1,5 m/s measured through an anemometer of hot thread, and a capsule was without isolation (pattern) and another was involved with a layer of 10 mm of the natural insulating composite. The figures 4 and 5 show details of the used system.

Figure 4. Capsules of aluminum: a-capsule pattern, b-capsule with composite.

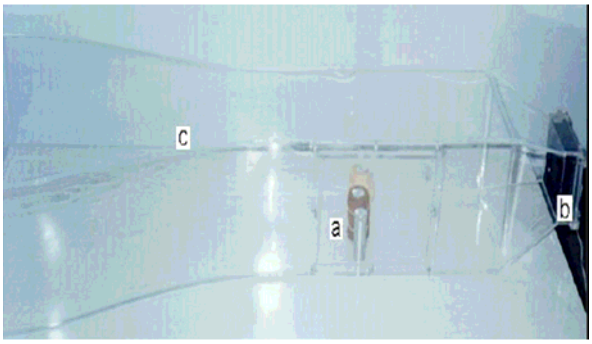

Figure 5. Wind tunnel: a-capsules with ice, b-fan, c-test section.

RESULTS AND DISCUSSION

- Resistance to the flow of heat in hot systems

The low diffusion of the heat on the part of the composite, was proven when in the analysis of the temperature gradient in the composite. It was verified in this experiment a temperature of 175ºC in the interface warm pin–composite, followed by values of 70ºC and 55ºC for distances of the interface of 5 mm and 10 mm respectively. Therefore, a gradient of temperature of 120ºC was verified in only 20 mm of thickness of the analyzed material, in other words, of the insulating thermal, denoting the characteristic of retention of heat of the same clearly, as it is observed in the figure 6.

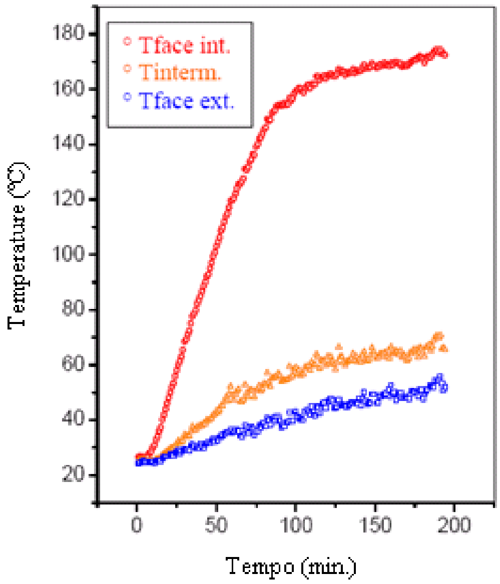

Figure 6. Temperature gradient in the composite.

- Resistance to the flow of heat in cold systems

Being observed the figure 7, it is noticed that after 30 min, while the temperature of the capsule pattern increased of 0,8ºC for 21,2ºC, therefore 20,4ºC. The isolated capsule with the natural composite passed of 0,5ºC for 0,8ºC, i.e., just increase 0,3ºC; the difference among the two capsules was of T = 20,4ºC.

After 45 min, the temperature difference among the two capsules decreased to T = 6,5ºC; 1 h then, the difference was in T = 2,2ºC, that difference stayed unaffected up to 2 h. At the end of 5 h45 min of measurements, the temperature difference between pattern and the composite became despicable (0,2ºC).

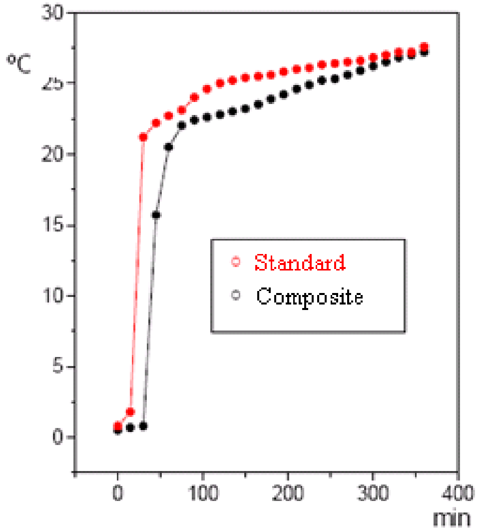

Figure 7. Resistance to heat flow: standard x natural isolating composite comparison.

Therefore, the results shown previously so much in what it plays to hot systems as in what it plays to cold systems, they denote the viability of technical application of the material clearly analyzed to be used as insulating thermal.

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