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COMPOSITE OF VINYL ACETATE COPOLYMERS WITH CELLULOSE WHISKERS

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INTRODUCTION

It is well known that emulsion polymerization is a versatile process to design materials, which can be easily processed either by film casting (water evaporation) or by classical extrusion processes. Composite of polymer latex with cellulose fibers is a very promised research area in order to develop new low-density materials with high resistance (improved stiffness, strength, hardness) and adhesives with higher elastic modulus. In previous works [1,2,3] the processing of composite with a polymeric matrix reinforced by natural cellulose whiskers was reported. Critical parameter influencing the properties of these composites is the size of the fibers and the interaction fiber-polymer. Many investigations have shown that the use of various surface treatments applied onto cellulose fibers can improve the dispersion quality and the mechanical properties of composite [4]. Different kinds of coupling agents such as silanes leads to changes in the surface structure of the fibers as well as changes in the surface energy [5] improving properties of composites. The interfacial bonds between the reinforcing fiber and the matrix have a significant effect on the performance of a composite material. In this work we studied a combined approach to increase interactions between nanometer cotton fibers (whiskers) from whatman papers and polyvinyl acetate copolymers. First the latex polymer was modified adding a new polar monomer mono dodecyl maleate (**MDM**). This monomer has two functional groups, an ester group and a carboxylic acid. One objective of this work is to evaluate this new functional monomer to increase interactions with cellulose fibers. Beside that, the whiskers were also modified physically and chemically whit Hydroxypropylcellulose **(HPC)**, 3-(trimetoxy silyl)-propyl methacrylate) **(MPS)** and Alkenyl succinic anhydride (**ASA**). In order to changes the surface characteristics of the fibers investigate interactions between cellulose whiskers (modified and un-modified) and modified vinyl acetate latex polymers.

RESULTS

Copolymer latex (modified and non-modified) were mixture with different amount of cellulose whiskers suspension (modified and non-modified), them were mixing during 15 minutes at room temperature. Homogenous mixture was put in a mold to form a films with thickness between 1 to 2 mm, that were obtained by water evaporation at 30°C during 1 week.

Dynamic Mechanical Measurements of Composite.

a) Vinyl Acetate-Butyl Acrylate Copolymer with Whiskers modified.

Figure 1 show plot of log (E'/Eo) (storage tensile modulus) at 1 Hz are normalize in base a matrix 1.The material composite of whiskers modified have a similar behavior that Vinyl Acetate Copolymer. In terminal zone the elastic tensile modulus of the matrix 1 become lower and lower with temperature however the elastic tensile modulus of composite material increase according of

coupling agent use for surface modification. These materials have a reinforcement effect due strong interaction between fibers and matrix 1.

b) Modified Vinyl Acetate Copolymer [6] with Whiskers Modified.
Dynamic mechanical measurements were performed on composite materials with modified whiskers and modified copolymer. The plot of log (E'/Eo) (storage tensile modulus) show Tg values of composite materials increase o decrease depend of coupling agent used on fibers surface (Figure 2). For composite materials prepared with fiber modified (**ASA** and **HPC**) have an increase in the composite modulus for temperature below Tg, However, the exact determination of the glassy modulus depends on the precise knowledge of the sample dimension. A temperature above Tg presents a greater increase in the composite modulus. Composite materials prepared with fiber modified (**ASA** and **HPC**) show an improve the thermal stability and bring a great reinforcing effect at high temperature. Composite prepared with whiskers surface modified present a better mechanical behavior in comparison with composites prepared with whiskers without modification and copolymer no-modified. Functional groups of surface form a cross linking with functional groups of whiskers and the matrix . The result is a strong network that give more reinforcing effect and thermal stability to composite materials.

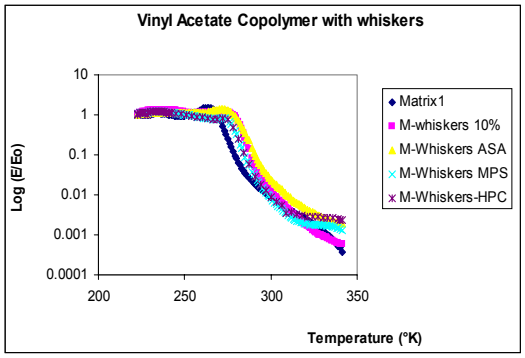

Figure 1

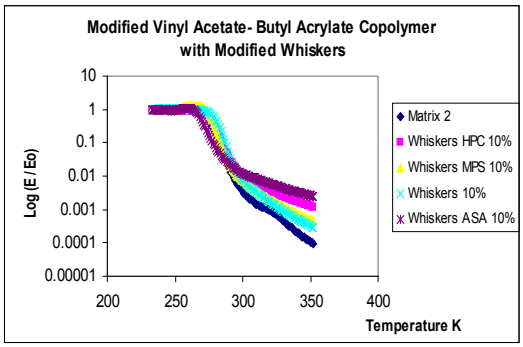

Figure 2

Acnowledgements
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