

- ✓ Description : paged ... to paged ...13...  
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□ Drawing(s) : paged ... to paged ...  
✓ Abstract : paged ...16... to paged ...

### A PROCESS FOR PREPARING WOOD COMPOSITION BOARD

This invention relates to a method for preparing wood composition board, such as hardboard, fabricated by consolidating fibers or chips under heat and pressure to form an integral board material.

Wood composition board such as, for example, hardboard, is manufactured by the reconsolidation of the de-fiberated wood chips under heat of up to 232°C (450 degrees F) and pressure up to about 82.64 bar (1,200 psi). The fibrous particles are first formed into a unitary mat, by either a dry process or a wet process, which is then consolidated into a solid board by applying heat and pressure. Prior to the reconsolidation of the defiberated wood chips and before applying heat and pressure, compositions containing synthetic items, such as polymeric dispersions, aminoplast resins and waxes, may be applied to the mat surface to increase the strength, integrity and enhanced water resistance. These compositions are referred to as "prepressed sealers".

The production of wood composition board prepared by a conventional process for preparing such products typically employ a step where the prepress sealer has to be applied to the composition board mat surface prior to the application of heat and pressure. The prepress sealer is conventionally applied to the fiber mat surface by spraying. This conventional spray method for transferring the prepress sealer to the mat surface results in significant losses of the prepress sealer into exhaust systems and air circulation systems.

Another shortcoming of applying the prepress sealer by spraying is the tendency to have an uneven distribution of prepress sealer on the board surface. This uneven application of the prepress sealer may create spots or surface discoloration in the final product, as well as increase the cost of production due to the inefficient transfer of the prepress sealer onto the mat.

US-A-3,607,341 discloses a process for producing foam coated textiles, and similar materials are produced by (a) foaming an aqueous emulsion latex composition containing about 1.5 to about 10 parts by weight of a water-soluble salt of a saturated organic acid to increase the volume of said latex from about 4 to about 12 times its original volume; (b) applying the thus obtained foam directly to said textile or similar substrate; (c) partially drying the foam and substrate to a moisture content of less than about 20 percent by weight while retaining the foam in its extended form during the

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drying process without gelation or curing the polymer; (d) crushing the partially dried and uncured foam, and (e) thereafter drying and curing the resultant crushed foam.

US-A-4,517,228 discloses a process for manufacturing composition boards which utilize a composition board coating having an acrylic emulsion present at 2.5 to 58% by weight solids, a platelet talc present at about 25 to 97% by weight solids, a crosslinking agent for the acrylic emulsion present at about 0.3 to 18% by weight solids and a high melting wax present at about 0.2 to 12% by weight solids level.

US-A-4,376,142 discloses a method for preparing a prime-coated fiberboard product by preparing a frothed aqueous latex prime coating having a foaming agent, the frothed coating having a consistency of 500 to 700 grams per liter, applying the coating at a rate of 220 to 320 grams per square meter of fiberboard and exposing the coated fiberboard to heat, thereby collapsing the froth and drying the coating.

The present invention aims to produce an improved composition board.

One aspect of the invention provides a process for preparing wood composition board by (a) foaming by air-whipping an aqueous emulsion polymerized latex composition comprising a polymer of an ethylenically unsaturated monomer which comprises a foaming agent and a wetting agent; (b) applying the resultant polymeric foam directly to a wooden mat substrate; (c) collapsing the polymeric foam on the wooden mat substrate; and (d) hot-pressing the foam coated wooden mat substrate to cure the polymer.

Another aspect of the invention provides a wood composition board having an acrylic polymer latex wherein the latex polymer is foamed from 4 to 12 times of the original volume and comprises from 0.5 to 10 weight percent of a water-soluble organic surfactant foaming agent and from 0.2 to 15 weight percent of a cationic, anionic or nonionic surfactant wetting agent or mixtures thereof.

In order to minimize the loss of product and to maximize the physical properties of the finished wood board, the present invention converts the sealer into a foam by employing a foaming agent and a wetting agent prior to subjecting the fibrous mat to heat and pressure.

By applying the prepress sealer using the composition and method of the present invention to the surface of fibrous mat prior to the application of heat and pressure, it is possible to obtain a finished composition board product which has superior surface properties, i.e., an absence of surface spotting caused by wood tannin, sugars or waxes. Additionally, the coating composition of the present invention exhibits excellent prepress release properties which aid in the continual removal of composition board product from the press plate after repeated applications of heat and pressure.





Another advantage of the coating composition of the present invention is that it does not carbonize under surface pressure and heat employed in preparing the composition board. In addition, the coating composition and method of the present invention allows for a more efficient and economical use of the prepress sealer. While another advantage of the foam prepress sealer of the present invention is that it allows for a more efficient use of subsequent applications of primer.

#### Preparation of Composition Board

The basic process for the preparation of the composition board from defiberated wooden chips is well-known in the art. Generally, this process is disclosed in US-A-3,098,785 and 4,238,438.

As subsequently used herein, the phrase "wood composition board" includes various hardboard, fiberboard, particleboard, waferboard and strandboard. Also included are wet processed hardboard, dry processed hardboard and wet/dry processed hardboard, medium density fiberboard and oriented strandboard.

The general process for the preparation of composition board from defiberated wooden chips involves using wood chips or particles which are steamed, converted to fibers, formed into a mat, and hot pressed to form a hardboard or fiberboard. Usually, the wood products are fed into a wood cooker and held under pressure of up to about 13.77 bar (200 psi) for less than about 10 minutes at temperatures ranging up to somewhat less than about 204°C (400 degrees F). The steam chips are then refined into fibers which are introduced into a felting zone, where a thermosetting glue and other additives such as low melting waxes and other synthetic additives are mixed with the fiber products. In most conventional processes, these additives are mixed with fibers. The fiber mat is then produced by spraying. The problem occurs when the prepress sealer is subsequently applied to the mat surface. Conventional processes use spraying to apply the prepress sealer to the surface of the mat. However, spraying results in an inefficient transfer of the sealer to the mat surface. Losses of the prepress sealer to the atmosphere and air ventilation and exhaust systems can be as high as about 40 percent. This results in both an economic loss of product as well as an environmentally unfriendly workplace.

After the glue and other additives are mixed with the fibers and the fibrous mat is produced, the prepress sealer is sprayed onto the surface. The wet or dry mat is then conveyed into a hot press where one or more cycles of heat and pressure are applied. In a typical operation, the mat is pressed for up to 10 seconds at 27.5 bar (400 psi), then for four (4) minutes at 30.9 bar (150 psi) and 232°C (450 degrees F). Generally, one or more



high pressure treatment steps may be employed with pressures up to about 82.6 bar (1200 psi) and temperatures from about 93°C to 315°C (200 to about 600 degrees F).

### Polymeric Dispersion

The basic process for the preparation of the polymeric dispersion of the present invention is well-known and is described more particularly in US-A-4,517,228.

The acrylic emulsion resin useful herein can be prepared by conventional emulsion process techniques, which involve the emulsion polymerization of various acrylic and other alpha beta ethylenically unsaturated monomers in the presence of free radical generating initiators and various surfactants or emulsification agents. These processes and products are well known in the art and will not be described further. In order to ensure that the acrylic emulsions are subject to crosslinking using the crosslinking agents described hereafter, they should contain from about 1.0 to about 30 percent by weight of a carboxyl or hydroxyl functional monomer. Examples of the acid monomers include acrylic, methacrylic, ethacrylic, crotonic and itaconic acids, as well as various half acid esters or maleic and fumaric acids. The hydroxy monomers include the hydroxyalkyl acrylates and methacrylates predominantly. Also included are other acrylate-type monomers, including acrylonitrile and methacrylonitrile and other related materials. In order to adjust the Tg of the polymers prepared according to the instant invention, up to about 40 percent by weight of an alpha-beta ethylenically unsaturated aromatic monomer copolymerizable with the aforementioned acrylate and methacrylate esters can be employed. Examples of such materials include styrene and vinyl toluene. Also included are up to about 60 percent by weight of another optional monomer copolymerizable with these first monomers, such as acrylamide, methylol (meth)acrylamide and methylolated ureidoethyl methacrylate. Monomers such as vinyl acetate, vinyl versate, and butadiene are another option. The acrylic emulsion useful herein should have a viscosity of less than 2,000 cps, preferably less than 1,000 cps, at a solids content of about 10 to about 60 percent by weight. The preferred emulsions useful herein are the anionic surfactant stabilized emulsions based upon, for example, alkylaryl sulfonates, sodium sulfosuccinate and ammonium lauryl sulfonate. Also preferred are the various polyethylene oxide and polypropylene oxide-based phenolic-type surfactant. However, the nonionic surfactant and cationic surfactant stabilized emulsions may also be employed herein.

The second element of the compositions of the invention is a melamine formaldehyde-type crosslinking agent for the acrylic emulsion. The curing agent should be water-soluble or readily water-dispersible, with or without the use of a co-



solvent, and is preferably a melamine-based crosslinking agent, although urea/formaldehyde-type curing agents may also be employed alone, or in combination with the melamine formaldehyde-type curing agents described hereafter. Basically, the crosslinking agents are preferably based upon polyalkoxymethylol melamine, with the hexamethoxymethylol melamines being most preferred. Crosslinkers such as glycourils and dimethylol-dihydroxyl ethylene urea are also considered useful in this purpose.

An optional component of the composition of the instant invention is a high-melting wax. Generally, these waxes must have a softening point in the range of above about 60°C (140 degrees F), preferably 65°C (150 degrees F). Most preferred among these waxes are waxes of the carnauba, polyethylene polymekan and micro crystalline.

Another optional component of the composition of the invention is a platelet, platey or micaceous form of talc. (Talc also occurs in these other forms: fibrous or foliated; acicular or tremolitic; and, nodular or steatite.) Generally, talc materials are of two types: hydrous or anhydrous. Both may be based upon magnesium silicate and may have the chemical formula  $\text{Mg}_3\text{Si}_4\text{O}_{10}(\text{OH})_2$  or  $3\text{MgO} \cdot 4\text{SiO}_2 \cdot \text{H}_2\text{O}$ . While either material may be used, the hydrated materials are most preferred. In either event, it is crucial that the talc compositions of the invention be of the platelet form. In general, it is preferred that the talc compositions of the invention have aspect ratios (average diameter/average thickness) of about 10:1 to 30:1, preferably about 15:1 to 25:1, and that they have diameters of about 1 to about 4 micrometers and thicknesses of about 0.5 to about 0.05 micrometers, preferably diameters of about 2 micrometers and thicknesses of about 0.1 micrometers.

The compositions of the invention may optionally be compounded with pigments, fillers, reinforcing agents, thickeners, flow control agents, release agents and other conventional coating formulation agents. In addition, the compositions of the invention may contain certain acidic or basic materials to adjust the pH to the range of above about 7, preferably from about 8 to 10. Lower pH materials are less stable and often will gel prior to use. Preferably, the composition herein should be compounded employing pigment volume concentrations in the range of about 0 (zero) to about 60 percent.

#### Foaming Agent

The polymerized latex emulsion produced according to the present invention preferably contains a water-soluble surfactant. Such water-soluble surfactant can function as a foaming agent and a foaming stabilizer. It has been found that when the water-soluble surfactant consists of, or contains, a substantial amount of a water-soluble



salt (or soap) of an 18 carbon atom aliphatic carboxylic acid, the foam produced may be readily processed. Particularly preferred are the water-soluble salts of 18 carbon atom aliphatic acid or mixtures of aliphatic carboxylic acids of from about 16 to about 20 carbon atoms, but containing a substantial amount, at least about 40%, and preferably over 50%, by weight, of an 18 carbon atom aliphatic carboxylic acid.

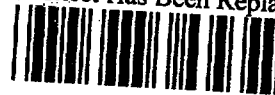
Examples of preferred aliphatic carboxylic acids include stearic acid, tallow fatty acids and oleic acid. Particularly preferred salts or soaps of stearic acid or of partially or fully hydrogenated fatty acids of natural origin which contain a major amount of stearic acid such as hydrogenated tallow acid, hydrogenated tall oil fatty acids, hydrogenated soy bean oil fatty acids, and hydrogenated tung acids. Preferred water-soluble salts or soaps of the above-mentioned acids are the alkali metal, usually sodium or potassium salt, the ammonium salts and the amine salts such as alkanolamine salts, e.g., mono-, di- and triethanolamine salts.

If desired, other water-soluble surfactants may be incorporated in the polymerized latex. Examples of such salts and soaps of fatty acids contain from 12-24 carbon atoms, included are salts of aliphatic or alkylary sulfonic acids or sulfates such as sodium lauryl sulfate and sodium dodecylbenzyl sulfate, as well as non-ionic surfactants such as polyethylene oxide condensates of higher fatty alcohols, higher aliphatic acids and alkylphenols. However, such auxiliary foaming agents should not be used in an amount greater than the salt of the C<sub>18</sub> aliphatic carboxylic acid.

Preferably the emulsion polymerized latex composition contains from about 0.2 to about 10 weight percent, and preferably about 1.0 to about 5 weight percent of water-soluble surfactant based on the dry weight of the polymer in the latex emulsion.

The emulsion polymerized latex composition starting material may be foamed by any of the known conventional mechanical or chemical foaming processes. While it is preferred to accomplish foaming by the air whipping method due to its easy procedure and its production of very fine uniform cell structure, other methods, such as releasing a non-coagulating gas such as nitrogen, or causing the decomposition of a gas liberating material to chemically react with an ingredient in the composition with the liberation of a non-coagulatable gas as a reaction product, or by use of an apparatus having commercially available foam heads may also be employed. These foaming processes may be carried out at around room temperature.

The key characteristic of the foam, used for manufacture of the wood composition board of the present invention, is that the foam must collapse between the time the foam is applied onto the surface of the mat and the time that the mat containing the foam comes in direct contact with the hot press plate. To accelerate the



foam collapse, air blowing, heating, or applying a vacuum at the bottom of the mat immediately after the foam is laid down on to the mat surface may be effective.

In order to produce wood composition board, preferably the volume of the latex composition containing the foaming agent is increased from about 4 to 50 times, preferably 10 to 15, times its original volume in the foaming step. The density of the foamed latex is indicative of the volume expansion. For example, a density of 0.1 is equivalent of one gram of dry solid increasing the volume 10 times.

The resulting foamed polymeric latex may then be applied directly to the mat surface by any method utilized in conventional procedures, apparatus or machinery known in the art. The technique of applying the foam is not in any way critical to the practice of this invention. Once applied to the mat or substrate, the foam polymer latex may be leveled to any desired thickness which will satisfy the ultimate thickness directed by economic consideration, the equipment used, and the desired end results. Leveling of the foam coating may be accomplished by using a doctor knife, a roll or a curtain coater.

#### The Wetting Agent

In preparation of the latex composition of the present invention, it is necessary to employ surfactants as wetting agents. Wetting agents are classically subdivided into three categories: anionic, cationic and nonionic surfactants.

The purpose of the wetting agent is to enhance surface wetting; to help wet surfaces which are not completely free from grease, wax or dirt; to distribute the prepress sealer uniformly on the fiber; and to collapse the foam on the fiber mat within a very short period of time before the foam is contacted with the hot press plate. The time period for collapsing the foam is generally from about 30 seconds to about two (2) minutes between the time that the foam is applied to the mat surface and the mat has contact with the heat and pressure.

In general, the cationic surfactants are the surface-active portion of the molecule which bears an apparent positive charge. Examples of cationic wetting agents useful in the present invention are selected from the group consisting of C<sub>12</sub> to C<sub>18</sub> primary, secondary and tertiary amines and salts thereof, diamines, polyamines and their salts, quaternary ammonium salts, polyoxyethylenate amines, quaternized polyoxyethylenate amines and amine oxides.

In general, the anionic surfactants are the surface-active portion of the molecule that bears an apparent negative charge. Examples of anionic wetting agents useful in the present invention are selected from the group consisting of alkylaryl sulfonates,



disodium mono ester sulfosuccinates, disodium isodecyl sulfosuccinates, disodium ethoxylated alcohol half ester of sulfosuccinic acid, disodium ethoxylated nonyl phenol half ester of sulfosuccinates, disodium alkyl amidoethanol sulfosuccinates, disodium alkyl amido polyethoxy sulfosuccinates, disodium alkyl amidoethanol sulfosuccinates, tetrasodium N-(1,2,-dicarboxy-ethyl)-N-octadecyl sulfosuccinates, disodium N-octadecyl sulfosuccinamate, sodium bistridecyl sulfosuccinates, sodium dioctyl sulfosuccinates, sodium dihexyl sulfosuccinates, sodium dioctyl sulfosuccinates, sodium diocyclohexyl sulfosuccinates, sodium diamyl sulfosuccinates, sodium diamyl sulfosuccinates and sodium diisobutyl sulfosuccinates.

In general, the nonionic surfactants are the surface-active molecule that bears no apparent ionic charge. Examples of nonionic wetting agents useful in the present invention are selected from the group consisting of polyoxyethylenated alkylphenols, alkylphenol ethoxylates, polyoxyethylenated straight-chain alcohol, amine polyglycol condensate, modified polyethoxy adducts, polyoxyethylenated mercaptans, long chain carboxylic acid esters, modified terminated alkylaryl ether and alkylpolyether alcohols.

The emulsion polymerized latex composition preferably contains from about 0.2 weight per cent to about 15 weight per cent of anionic and/or cationic and/or nonionic surfactants and mixtures thereof. More preferably, the levels of anionic, cationic and nonionic surfactants are from about 0.5 weight per cent to about 5 weight per cent based on the total latex solids.

### Defoaming Technology

It is critical to the process of the present invention, as discussed above, to have the foamed latex polymer collapse at the appropriate time. Additionally, it is also critical to select appropriate foaming and wetting agents in the practice of the present invention. However, mechanical means such as, for example, heat, vacuum, air blowing or ultra sonic, offer an addition alternative to collapse the foam.

The invention will now be described with reference to the following examples:

## EXAMPLES

### Examples 1-5

Clear acrylic emulsion foams in Examples 1-5 were evaluated for ease of foaming, foam density, pore size and time of foam collapse. The composition used in these Examples are given in the following table.



| Examples                        | 1                | 2   | 3   | 4   | 5   |
|---------------------------------|------------------|-----|-----|-----|-----|
|                                 | (part by weight) |     |     |     |     |
| Rhoplex E-2893                  | 100              | 100 | 100 | 100 | 100 |
| Sipon L-22<br>(foaming agent)   | 0                | .5  | 1.0 | 2.0 | 4.0 |
| Triton GR-5M<br>(wetting agent) | 0                | .2  | .4  | .6  | .8  |
| Water                           | 123              | 123 | 123 | 123 | 123 |

Rhoplex E-2893 is a waterborne acrylic latex manufactured by Rohm and Haas Co.

Sipon L-22 is an aqueous solution of ammonium lauryl sulfate in 28% solid, manufactured by Rhone-Poulenc Co.

Triton GR-5M is anionic surfactant, manufactured by Union Carbide Co.

Properties of the foams show as follows:

| Examples      | 1           | 2           | 3       | 4       | 5       |
|---------------|-------------|-------------|---------|---------|---------|
| Ease of Foami | fair        | good        | very    | very    | extreme |
| Foam Size     | not uniform | not uniform | uniform | uniform | uniform |
| Foam Quality  | unstable    | unstable    | stable  | stable  | stable  |

Examples 1 indicates that without a foaming agent and a wetting agent, the foam size is not uniform, and the foam quality is not stable.



### Examples 6-10

Pigmented prepress sealer foams in Examples 6-10 were evaluated for their ease of foaming, foam density, pore size, time of foam collapse and press release performance after the coated boards were hot-pressed.

The composition used in these examples are given the following table.

| Examples                                | 6                | 7   | 8   | 9   | 10  |
|-----------------------------------------|------------------|-----|-----|-----|-----|
|                                         | (part by weight) |     |     |     |     |
| Pigmented In-press Coating (610-D5-111) | 100              | 100 | 100 | 100 | 100 |
| Sipon L-22 (foaming agent)              | .5               | .5  | .5  | .5  | .5  |
| Triton GR-5M (wetting agent)            | 0                | .1  | .2  | .3  | .4  |
| Water                                   | 135              | 135 | 135 | 135 | 135 |

610-D5-111 in-press coating is manufactured by Akzo Coatings Co.

Sipon L-22 is an aqueous solution of ammonium lauryl sulfate in 28% solid, manufactured by Rhone-Poulenc Co.

Triton GR-5M is anionic surfactant, manufactured by Union Carbide.

### Properties of the foams and performance of the foam-coated boards

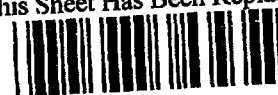
| Examples                       | 6       | 7       | 8       | 9       | 10      |
|--------------------------------|---------|---------|---------|---------|---------|
| Ease of Foaming                | good    | good    | good    | good    | good    |
| Foam Density g/cm <sup>3</sup> | 0.06    | 0.05    | 0.05    | 0.05    | 0.05    |
| Foam Quality                   | uniform | uniform | uniform | uniform | uniform |
| Board released from press      | 8       | 9       | 10      | 10      | 10      |

Press release: 10: automatic release from the hot-press plate

9: momentary sticking automatic release

8: must tap to release from the hot-press

0: cannot be released



Examples 6 and 7 show that with a foaming agent and insufficient wetting agent, the press release performance was unsatisfactory. Examples 8 and 10 provide satisfactory press release.

### Example 11 - 13

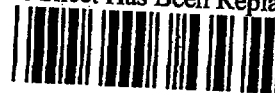
Foams in Example 11-13 were prepared in the same way as Example 10 except for changing the foaming agent.

| Examples                         | 11                | 12      | 13      |
|----------------------------------|-------------------|---------|---------|
|                                  | (parts by weight) |         |         |
| Pigmented In-press               |                   |         |         |
| Coating (610-D5-120)             | 100               | 100     | 100     |
| Stanfax-320                      | .5                |         |         |
| (foaming agent)                  |                   |         |         |
| Triton W-30                      |                   | .5      |         |
| (foaming agent)                  |                   |         |         |
| Monamid-150 ADD                  |                   |         | .5      |
| (foaming agent)                  |                   |         |         |
| Triton GR-5M                     | .2                | .2      | .2      |
| (wetting agent)                  |                   |         |         |
| Water                            | 135               | 135     | 135     |
| Ease of Foaming                  | good              | good    | good    |
| Foam density(g/cm <sup>3</sup> ) | 0.06              | 0.05    | 0.10    |
| Foam size                        | uniform           | uniform | uniform |
| Board released from press        | 10                | 10      | 10      |

Stanfax 320 is Ammonium Stearate, manufactured by Adhesive & Chemical Co.

Triton W-30 and Triton GR-5M are Sodium alkylaryl ether sulfate and Dioctyl sodium sulfosuccinate respectively, manufactured by Union Carbide.

Monamid-150 ADD is fatty acid-alkanolamide, manufactured by Mona Industries, Inc.

Examples 14-16

Foams were prepared in the same way as Example 9 except for changing wetting agent.

| Examples                                     | 14      | 15<br>(parts by weight) | 16      |
|----------------------------------------------|---------|-------------------------|---------|
| Pigmented In-press<br>Coating (610-D5-120)   | 100     | 100                     | 100     |
| Sipon L-22<br>(foaming agent)                | 3.0     | 3.0                     | 3.0     |
| Triton X-405 (nonionic)<br>(wetting agent)   | 1.0     |                         |         |
| Triton GR-5M (anionic)<br>(wetting agent)    |         | 1.0                     |         |
| Fluorad FC-135 (cationic)<br>(wetting agent) |         |                         | .3      |
| Ease of foaming                              | good    | good                    | good    |
| Foam density(g/cm <sup>3</sup> )             | 0.05    | 0.04                    | 0.06    |
| Foam size                                    | uniform | uniform                 | uniform |
| Boards released from press                   | 10      | 10                      | 10      |

Triton X-405 is Octyl phenoxy polyethoxy ethanol, manufactured by Union Carbide.

Triton GR-5M is Dioctyl sodium sulfosuccinate, manufactured by Union Carbide.

FC-135 is Fluoroalkyl quaternary ammonium iodide, manufactured by 3M Co.

Examples 17-20

Foams in Examples 17-20 were prepared the same way as Example 15 with different levels of coating on the boards.

| Examples                                             | 17 | 18  | 19  | 20  |
|------------------------------------------------------|----|-----|-----|-----|
| Amount of Add-on<br>dry film thickness<br>0.001 inch | .5 | 1.0 | 2.0 | 4.0 |
| Press released<br>Performance                        | 10 | 10  | 10  | 10  |
| Hiding                                               | 2  | 7   | 10  | 10  |
| Water permeation                                     | 15 | 8   | 6   | 4   |
| Tape adhesion (%)                                    | 85 | 20  | 8   | 0   |

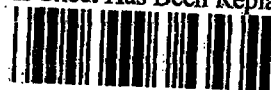
Hiding: 10: perfect hiding, 0 (zero): no hiding

Water permeation: grams per sq inch per 24 hrs. of water pass through the film and retained in boards.

Tape adhesion: percent fiber pulled using 3M, #250 tape with 90 degree to the surface abrupt pull. 0 (zero) percent pull is a perfect adhesion, 100 percent pull is indicative of total failure.



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### Claims

1. A process for preparing wood composition board, comprising (a) foaming by air-whipping an aqueous emulsion polymerized latex composition comprising a polymer of an ethylenically unsaturated monomer which comprises a foaming agent and a wetting agent;  
(b) applying the resultant polymeric foam directly to a wooden mat substrate;  
(c) collapsing the polymeric foam on the wooden mat substrate; and  
(d) hot-pressing the foam-coated wooden mat substrate to cure the polymer.
2. The process according to claim 1, wherein the latex is an acrylic latex polymer.
3. The process according to claims 1 or 2, wherein the latex polymer is foamed from 4 to 50 times of the original volume.
4. The process of claims 2 or 3, wherein the acrylic latex polymer contains from 0.2 to 10 weight percent of water-soluble surfactant foaming agent, based on the total formulation solids.
5. The process of claims 2,3 or 4, wherein the acrylic latex polymer contains a water-soluble organic surfactant foaming agent selected from the group consisting of alkali metal, ammonium and amine salts of higher fatty acids and mixtures thereof.
6. The process of any one of claims 2-5, wherein the acrylic latex polymer contains from 1.0 to 5 weight percent of the water-soluble organic surfactant foaming agent, based on the total formulation solids, and wherein preferably the water-soluble organic surfactant foaming agent is ammonium lauryl sulfate.
7. The process of any one of claims 2-6, wherein the acrylic latex polymer contains a cationic, anionic and nonionic surfactant wetting agent or mixtures thereof; and wherein preferably the cationic surfactant wetting agent is selected from the group consisting of C<sub>12</sub> to C<sub>18</sub> primary, secondary and tertiary amines and salts thereof, diamines, polyamines and their salts, quaternary ammonium salts, polyoxyethylenate amines, quaternized polyoxyethylenate amines and amine oxides; the anionic surfactant wetting agent is selected from the group consisting of alkylaryl sulfonates, disodium mono ester sulfosuccinates, disodium isodecyl sulfosuccinates, disodium ethoxylated



alcohol half ester of sulfosuccinic acid, disodium ethoxylated nonyl phenol half ester of sulfosuccinates, disodium alkyl amidoethanol sulfosuccinates, disodium alkyl amido polyethoxy sulfosuccinates, disodium alkyl amidoethanol sulfosuccinates, tetrasodium N-(1,2,-dicarboxy-ethyl-)-N-octadecyl sulfosuccinates, disodium N-octadecyl sulfosuccinates, sodium bistridecyl sulfosuccinates, sodium dioctyl sulfosuccinates, sodium dihexyl sulfosuccinates, sodium dioctyl sulfosuccinates, sodium diocyclohexyl sulfosuccinates, sodium diamyl sulfosuccinates, sodium diamyl sulfosuccinates and sodium diisobutyl sulfosuccinates; and the nonionic surfactant wetting agent is selected from the group consisting of polyoxyethylenated alkylphenols, alkylphenol ethoxylates, polyoxyethylenated straight-chain alcohol, amine polyglycol condensate, modified polyethoxy adducts, polyoxyethylenated mercaptans, long chain carboxylic acid esters, modified terminated alkylaryl ether, and alkylpolyether alcohols.

8. The process of claim 7, wherein the acrylic latex polymer contains from 0.2 to 15 weight percent of the anionic, cationic or nonionic surfactant wetting agent, based on the total formulation solids.
9. The process of any one of the preceding claims, wherein the substrate is selected from the group consisting of hardboard, fiberboard, particleboard, waferboard, and strandboard, wet processed hard board, dry processed hardboard, wet/dry processed hardboard, medium density fiber- board and oriented strandboard.
10. A wood composition board comprising an acrylic polymer latex wherein the latex polymer is foamed from 4 to 50 times of the original volume and contains from 0.2 to 10 weight percent of a water-soluble organic surfactant foaming agent and from 0.2 to 15 weight percent of a cationic, anionic or nonionic surfactant wetting agent, or mixtures thereof.

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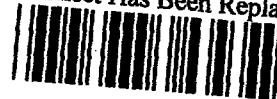
ABSTRACT

A PROCESS FOR PREPARING WOOD COMPOSITION BOARD

This invention relates to a method for preparing wood composition board, such as hard board, fabricated consolidating fibers or chips under heat and pressure to form an integral board material.

More particularly, this invention relates to an improved method for applying a clear or pigmented prepress coating, also known as a prepress sealer, to the surface of a fibrous mat by converting the prepress sealer into foam prior to subjecting the mat to a temperature and pressure press treatment.

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| <input type="checkbox"/>            | Drawing(s) : paged 16. to paged 17. |    |
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### A PROCESS FOR PREPARING WOOD COMPOSITION BOARD

This invention relates to a method for preparing wood composition board, such as hardboard, fabricated by consolidating fibers or chips under heat and pressure to form an integral board material.

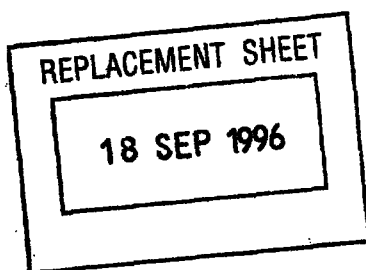
Wood composition board such as, for example, hardboard, is manufactured by the reconsolidation of the de-fiberated wood chips under heat of up to 232°C (450 degrees F) and pressure up to about 82.64 bar (1,200 psi). The fibrous particles are first formed into a unitary mat, by either a dry process or a wet process, which is then consolidated into a solid board by applying heat and pressure. Prior to the reconsolidation of the defiberated wood chips and before applying heat and pressure, compositions containing synthetic items, such as polymeric dispersions, aminoplast resins and waxes, may be applied to the mat surface to increase the strength, integrity and enhanced water resistance. These compositions are referred to as "prepressed sealers".

The production of wood composition board prepared by a conventional process for preparing such products typically employ a step where the prepress sealer has to be applied to the composition board mat surface prior to the application of heat and pressure. The prepress sealer is conventionally applied to the fiber mat surface by spraying. This conventional spray method for transferring the prepress sealer to the mat surface results in significant losses of the prepress sealer into exhaust systems and air circulation systems.

Another shortcoming of applying the prepress sealer by spraying is the tendency to have an uneven distribution of prepress sealer on the board surface. This uneven application of the prepress sealer may create spots or surface discoloration in the final product, as well as increase the cost of production due to the inefficient transfer of the prepress sealer onto the mat.

US-A-3,607,341 discloses a process for producing foam coated textiles, and similar materials are produced by (a) foaming an aqueous emulsion latex composition containing about 1.5 to about 10 parts by weight of a water-soluble salt of a saturated organic acid to increase the volume of said latex from about 4 to about 12 times its original volume; (b) applying the thus obtained foam directly to said textile or similar substrate; (c) partially drying the foam and substrate to a moisture content of less than about 20 percent by weight while retaining the foam in its extended form during the

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drying process without gelation or curing the polymer; (d) crushing the partially dried and uncured foam, and (e) thereafter drying and curing the resultant crushed foam.

US-A-4,517,228 discloses a process for manufacturing composition boards which utilize a composition board coating having an acrylic emulsion present at 2.5 to 58% by weight solids, a platelet talc present at about 25 to 97% by weight solids, a crosslinking agent for the acrylic emulsion present at about 0.3 to 18% by weight solids and a high melting wax present at about 0.2 to 12% by weight solids level.

US-A-4,376,142 discloses a method for preparing a prime-coated fiberboard product by preparing a frothed aqueous latex prime coating having a foaming agent, the frothed coating having a consistency of 500 to 700 grams per liter, applying the coating at a rate of 220 to 320 grams per square meter of fiberboard and exposing the coated fiberboard to heat, thereby collapsing the froth and drying the coating.

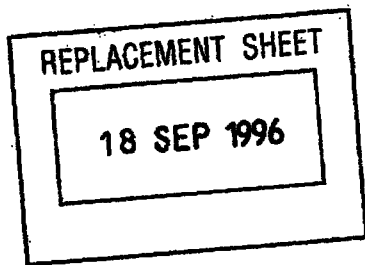
The present invention aims to produce an improved composition board.

One aspect of the invention provides a process for preparing wood composition board by (a) foaming by air-whipping an aqueous emulsion polymerized latex composition comprising a polymer of an ethylenically unsaturated monomer which comprises a foaming agent and a wetting agent; (b) applying the resultant polymeric foam directly to a wooden mat substrate; (c) collapsing the polymeric foam on the wooden mat substrate; and (d) hot-pressing the foam coated wooden mat substrate to cure the polymer.

Another aspect of the invention provides a wood composition board having an acrylic polymer latex wherein the latex polymer is foamed from 4 to 12 times of the original volume and comprises from 0.5 to 10 weight percent of a water-soluble organic surfactant foaming agent and from 0.2 to 15 weight percent of a cationic, anionic or nonionic surfactant wetting agent or mixtures thereof.

In order to minimize the loss of product and to maximize the physical properties of the finished wood board, the present invention converts the sealer into a foam by employing a foaming agent and a wetting agent prior to subjecting the fibrous mat to heat and pressure.

By applying the prepress sealer using the composition and method of the present invention to the surface of fibrous mat prior to the application of heat and pressure, it is possible to obtain a finished composition board product which has superior surface properties, i.e., an absence of surface spotting caused by wood tannin, sugars or waxes. Additionally, the coating composition of the present invention exhibits excellent prepress release properties which aid in the continual removal of composition board product from the press plate after repeated applications of heat and pressure.



Another advantage of the coating composition of the present invention is that it does not carbonize under surface pressure and heat employed in preparing the composition board. In addition, the coating composition and method of the present invention allows for a more efficient and economical use of the prepress sealer. While another advantage of the foam prepress sealer of the present invention is that it allows for a more efficient use of subsequent applications of primer.

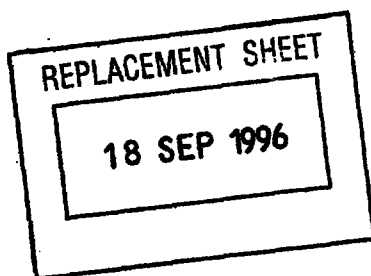
#### Preparation of Composition Board

The basic process for the preparation of the composition board from defiberated wooden chips is well-known in the art. Generally, this process is disclosed in US-A-3,098,785 and 4,238,438.

As subsequently used herein, the phrase "wood composition board" includes various hardboard, fiberboard, particleboard, waferboard and strandboard. Also included are wet processed hardboard, dry processed hardboard and wet/dry processed hardboard, medium density fiberboard and oriented strandboard.

The general process for the preparation of composition board from defiberated wooden chips involves using wood chips or particles which are steamed, converted to fibers, formed into a mat, and hot pressed to form a hardboard or fiberboard. Usually, the wood products are fed into a wood cooker and held under pressure of up to about 13.77 bar (200 psi) for less than about 10 minutes at temperatures ranging up to somewhat less than about 204°C (400 degrees F). The steam chips are then refined into fibers which are introduced into a felting zone, where a thermosetting glue and other additives such as low melting waxes and other synthetic additives are mixed with the fiber products. In most conventional processes, these additives are mixed with fibers. The fiber mat is then produced by spraying. The problem occurs when the prepress sealer is subsequently applied to the mat surface. Conventional processes use spraying to apply the prepress sealer to the surface of the mat. However, spraying results in an inefficient transfer of the sealer to the mat surface. Losses of the prepress sealer to the atmosphere and air ventilation and exhaust systems can be as high as about 40 percent. This results in both an economic loss of product as well as an environmentally unfriendly workplace.

After the glue and other additives are mixed with the fibers and the fibrous mat is produced, the prepress sealer is sprayed onto the surface. The wet or dry mat is then conveyed into a hot press where one or more cycles of heat and pressure are applied. In a typical operation, the mat is pressed for up to 10 seconds at 27.5 bar (400 psi), then for four (4) minutes at 30.9 bar (150 psi) and 232°C (450 degrees F). Generally, one or more



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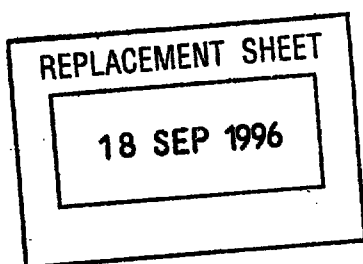
high pressure treatment steps may be employed with pressures up to about 82.6 bar (1200 psi) and temperatures from about 93°C to 315°C (200 to about 600 degrees F).

### Polymeric Dispersion

The basic process for the preparation of the polymeric dispersion of the present invention is well-known and is described more particularly in US-A-4,517,228.

The acrylic emulsion resin useful herein can be prepared by conventional emulsion process techniques, which involve the emulsion polymerization of various acrylic and other alpha beta ethylenically unsaturated monomers in the presence of free radical generating initiators and various surfactants or emulsification agents. These processes and products are well known in the art and will not be described further. In order to ensure that the acrylic emulsions are subject to crosslinking using the crosslinking agents described hereafter, they should contain from about 1.0 to about 30 percent by weight of a carboxyl or hydroxyl functional monomer. Examples of the acid monomers include acrylic, methacrylic, ethacrylic, crotonic and itaconic acids, as well as various half acid esters or maleic and fumaric acids. The hydroxy monomers include the hydroxyalkyl acrylates and methacrylates predominantly. Also included are other acrylate-type monomers, including acrylonitrile and methacrylonitrile and other related materials. In order to adjust the Tg of the polymers prepared according to the instant invention, up to about 40 percent by weight of an alpha-beta ethylenically unsaturated aromatic monomer copolymerizable with the aforementioned acrylate and methacrylate esters can be employed. Examples of such materials include styrene and vinyl toluene. Also included are up to about 60 percent by weight of another optional monomer copolymerizable with these first monomers, such as acrylamide, methylol (meth)acrylamide and methylolated ureidoethyl methacrylate. Monomers such as vinyl acetate, vinyl versatate, and butadiene are another option. The acrylic emulsion useful herein should have a viscosity of less than 2,000 cps, preferably less than 1,000 cps, at a solids content of about 10 to about 60 percent by weight. The preferred emulsions useful herein are the anionic surfactant stabilized emulsions based upon, for example, alkylaryl sulfonates, sodium sulfosuccinate and ammonium lauryl sulfonate. Also preferred are the various polyethylene oxide and polypropylene oxide-based phenolic-type surfactant. However, the nonionic surfactant and cationic surfactant stabilized emulsions may also be employed herein.

The second element of the compositions of the invention is a melamine formaldehyde-type crosslinking agent for the acrylic emulsion. The curing agent should be water-soluble or readily water-dispersible, with or without the use of a co-



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solvent, and is preferably a melamine-based crosslinking agent, although urea/formaldehyde-type curing agents may also be employed alone, or in combination with the melamine formaldehyde-type curing agents described hereafter. Basically, the crosslinking agents are preferably based upon polyalkoxymethylol melamine, with the hexamethoxymethylol melamines being most preferred. Crosslinkers such as glycourils and dimethylol-dihydroxyl ethylene urea are also considered useful in this purpose.

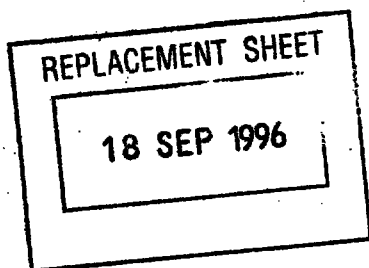
An optional component of the composition of the instant invention is a high-melting wax. Generally, these waxes must have a softening point in the range of above about 60°C (140 degrees F), preferably 65°C (150 degrees F). Most preferred among these waxes are waxes of the carnauba, polyethylene polymekane and micro crystalline.

Another optional component of the composition of the invention is a platelet, platey or micaceous form of talc. (Talc also occurs in these other forms: fibrous or foliated; acicular or tremolitic; and, nodular or steatite.) Generally, talc materials are of two types: hydrous or anhydrous. Both may be based upon magnesium silicate and may have the chemical formula  $Mg_3Si_4O_{10}(OH)_2$  or  $3MgO \cdot 4SiO_2 \cdot H_2O$ . While either material may be used, the hydrated materials are most preferred. In either event, it is crucial that the talc compositions of the invention be of the platelet form. In general, it is preferred that the talc compositions of the invention have aspect ratios (average diameter/average thickness) of about 10:1 to 30:1, preferably about 15:1 to 25:1, and that they have diameters of about 1 to about 4 micrometers and thicknesses of about 0.5 to about 0.05 micrometers, preferably diameters of about 2 micrometers and thicknesses of about 0.1 micrometers.

The compositions of the invention may optionally be compounded with pigments, fillers, reinforcing agents, thickeners, flow control agents, release agents and other conventional coating formulation agents. In addition, the compositions of the invention may contain certain acidic or basic materials to adjust the pH to the range of above about 7, preferably from about 8 to 10. Lower pH materials are less stable and often will gel prior to use. Preferably, the composition herein should be compounded employing pigment volume concentrations in the range of about 0 (zero) to about 60 percent.

#### Foaming Agent

The polymerized latex emulsion produced according to the present invention preferably contains a water-soluble surfactant. Such water-soluble surfactant can function as a foaming agent and a foaming stabilizer. It has been found that when the water-soluble surfactant consists of, or contains, a substantial amount of a water-soluble



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salt (or soap) of an 18 carbon atom aliphatic carboxylic acid, the foam produced may be readily processed. Particularly preferred are the water-soluble salts of 18 carbon atom aliphatic acid or mixtures of aliphatic carboxylic acids of from about 16 to about 20 carbon atoms, but containing a substantial amount, at least about 40%, and preferably over 50%, by weight, of an 18 carbon atom aliphatic carboxylic acid.

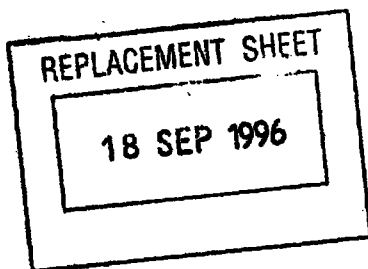
Examples of preferred aliphatic carboxylic acids include stearic acid, tallow fatty acids and oleic acid. Particularly preferred salts or soaps of stearic acid or of partially or fully hydrogenated fatty acids of natural origin which contain a major amount of stearic acid such as hydrogenated tallow acid, hydrogenated tall oil fatty acids, hydrogenated soy bean oil fatty acids, and hydrogenated tung acids. Preferred water-soluble salts or soaps of the above-mentioned acids are the alkali metal, usually sodium or potassium salt, the ammonium salts and the amine salts such as alkanolamine salts, e.g., mono-, di- and triethanolamine salts.

If desired, other water-soluble surfactants may be incorporated in the polymerized latex. Examples of such salts and soaps of fatty acids contain from 12-24 carbon atoms, included are salts of aliphatic or alkylary sulfonic acids or sulfates such as sodium lauryl sulfate and sodium dodecylbenzyl sulfate, as well as non-ionic surfactants such as polyethylene oxide condensates of higher fatty alcohols, higher aliphatic acids and alkylphenols. However, such auxiliary foaming agents should not be used in an amount greater than the salt of the C<sub>18</sub> aliphatic carboxylic acid.

Preferably the emulsion polymerized latex composition contains from about 0.2 to about 10 weight percent, and preferably about 1.0 to about 5 weight percent of water-soluble surfactant based on the dry weight of the polymer in the latex emulsion.

The emulsion polymerized latex composition starting material may be foamed by any of the known conventional mechanical or chemical foaming processes. While it is preferred to accomplish foaming by the air whipping method due to its easy procedure and its production of very fine uniform cell structure, other methods, such as releasing a non-coagulating gas such as nitrogen, or causing the decomposition of a gas-liberating material to chemically react with an ingredient in the composition with the liberation of a non-coagulatable gas as a reaction product, or by use of an apparatus having commercially available foam heads may also be employed. These foaming processes may be carried out at around room temperature.

The key characteristic of the foam, used for manufacture of the wood composition board of the present invention, is that the foam must collapse between the time the foam is applied onto the surface of the mat and the time that the mat containing the foam comes in direct contact with the hot press plate. To accelerate the



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foam collapse, air blowing, heating, or applying a vacuum at the bottom of the mat immediately after the foam is laid down on to the mat surface may be effective.

In order to produce wood composition board, preferably the volume of the latex composition containing the foaming agent is increased from about 4 to 50 times, preferably 10 to 15, times its original volume in the foaming step. The density of the foamed latex is indicative of the volume expansion. For example, a density of 0.1 is equivalent of one gram of dry solid increasing the volume 10 times.

The resulting foamed polymeric latex may then be applied directly to the mat surface by any method utilized in conventional procedures, apparatus or machinery known in the art. The technique of applying the foam is not in any way critical to the practice of this invention. Once applied to the mat or substrate, the foam polymer latex may be leveled to any desired thickness which will satisfy the ultimate thickness directed by economic consideration, the equipment used, and the desired end results. Leveling of the foam coating may be accomplished by using a doctor knife, a roll or a curtain coater.

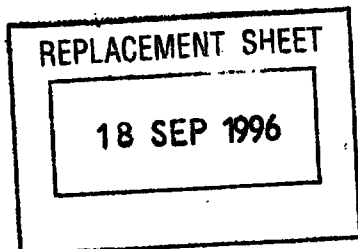
#### The Wetting Agent

In preparation of the latex composition of the present invention, it is necessary to employ surfactants as wetting agents. Wetting agents are classically subdivided into three categories: anionic, cationic and nonionic surfactants.

The purpose of the wetting agent is to enhance surface wetting; to help wet surfaces which are not completely free from grease, wax or dirt; to distribute the prepress sealer uniformly on the fiber; and to collapse the foam on the fiber mat within a very short period of time before the foam is contacted with the hot press plate. The time period for collapsing the foam is generally from about 30 seconds to about two (2) minutes between the time that the foam is applied to the mat surface and the mat has contact with the heat and pressure.

In general, the cationic surfactants are the surface-active portion of the molecule which bears an apparent positive charge. Examples of cationic wetting agents useful in the present invention are selected from the group consisting of C<sub>12</sub> to C<sub>18</sub> primary, secondary and tertiary amines and salts thereof, diamines, polyamines and their salts, quaternary ammonium salts, polyoxyethylenate amines, quaternized polyoxyethylenate amines and amine oxides.

In general, the anionic surfactants are the surface-active portion of the molecule that bears an apparent negative charge. Examples of anionic wetting agents useful in the present invention are selected from the group consisting of alkylaryl sulfonates,



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disodium mono ester sulfosuccinates, disodium isodecyl sulfosuccinates, disodium ethoxylated alcohol half ester of sulfosuccinic acid, disodium ethoxylated nonyl phenol half ester of sulfosuccinates, disodium alkyl amidoethanol sulfosuccinates, disodium alkyl amido polyethoxy sulfosuccinates, disodium alkyl amidoethanol sulfosuccinates, tetrasodium N-(1,2,-dicarboxy-ethyl-)-N-octadecyl sulfosuccinates, disodium N-octadecyl sulfosuccinamate, sodium bistridecyl sulfosuccinates, sodium dioctyl sulfosuccinates, sodium dihexyl sulfosuccinates, sodium dioctyl sulfosuccinates, sodium diocyclohexyl sulfosuccinates, sodium diamyl sulfosuccinates, sodium diamyl sulfosuccinates and sodium diisobutyl sulfosuccinates.

In general, the nonionic surfactants are the surface-active molecule that bears no apparent ionic charge. Examples of nonionic wetting agents useful in the present invention are selected from the group consisting of polyoxyethylenated alkylphenols, alkylphenol ethoxylates, polyoxyethylenated straight-chain alcohol, amine polyglycol condensate, modified polyethoxy adducts, polyoxyethylenated mercaptans, long chain carboxylic acid esters, modified terminated alkylaryl ether and alkylpolyether alcohols.

The emulsion polymerized latex composition preferably contains from about 0.2 weight per cent to about 15 weight per cent of anionic and/or cationic and/or nonionic surfactants and mixtures thereof. More preferably, the levels of anionic, cationic and nonionic surfactants are from about 0.5 weight per cent to about 5 weight per cent based on the total latex solids.

### Defoaming Technology

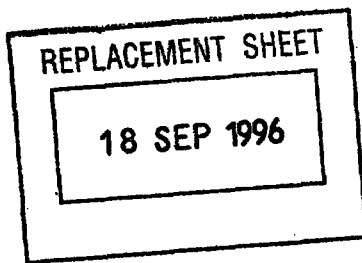
It is critical to the process of the present invention, as discussed above, to have the foamed latex polymer collapse at the appropriate time. Additionally, it is also critical to select appropriate foaming and wetting agents in the practice of the present invention. However, mechanical means such as, for example, heat, vacuum, air blowing or ultra sonic, offer an addition alternative to collapse the foam.

The invention will now be described with reference to the following examples:

### EXAMPLES

#### Examples 1-5

Clear acrylic emulsion foams in Examples 1-5 were evaluated for ease of foaming, foam density, pore size and time of foam collapse. The composition used in these Examples are given in the following table.



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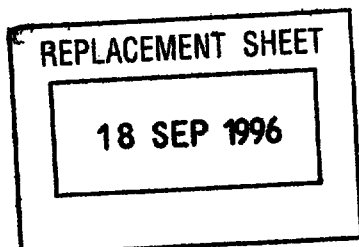
| Examples                        | 1                | 2   | 3   | 4   | 5   |
|---------------------------------|------------------|-----|-----|-----|-----|
|                                 | (part by weight) |     |     |     |     |
| Rhoplex E-2893                  | 100              | 100 | 100 | 100 | 100 |
| Sipon L-22<br>(foaming agent)   | 0                | .5  | 1.0 | 2.0 | 4.0 |
| Triton GR-5M<br>(wetting agent) | 0                | .2  | .4  | .6  | .8  |
| Water                           | 123              | 123 | 123 | 123 | 123 |

Rhoplex E-2893 is a waterborne acrylic latex manufactured by Rohm and Haas Co.  
Sipon L-22 is an aqueous solution of ammonium lauryl sulfate in 28% solid,  
manufactured by Rhone-Poulenc Co.  
Triton GR-5M is anionic surfactant, manufactured by Union Carbide Co.

Properties of the foams show as follows:

| Examples      | 1           | 2           | 3       | 4       | 5       |
|---------------|-------------|-------------|---------|---------|---------|
| Ease of Foami | fair        | good        | very    | very    | extreme |
| Foam Size     | not uniform | not uniform | uniform | uniform | uniform |
| Foam Quality  | unstable    | unstable    | stable  | stable  | stable  |

Examples 1 indicates that without a foaming agent and a wetting agent, the foam size is not uniform, and the foam quality is not stable.



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### Examples 6-10

Pigmented prepress sealer foams in Examples 6-10 were evaluated for their ease of foaming, foam density, pore size, time of foam collapse and press release performance after the coated boards were hot-pressed.

The composition used in these examples are given in the following table.

| Examples                                | 6                | 7   | 8   | 9   | 10  |
|-----------------------------------------|------------------|-----|-----|-----|-----|
|                                         | (part by weight) |     |     |     |     |
| Pigmented In-press Coating (610-D5-111) | 100              | 100 | 100 | 100 | 100 |
| Sipon L-22 (foaming agent)              | .5               | .5  | .5  | .5  | .5  |
| Triton GR-5M (wetting agent)            | 0                | .1  | .2  | .3  | .4  |
| Water                                   | 135              | 135 | 135 | 135 | 135 |

610-D5-111 in-press coating is manufactured by Akzo Coatings Co.

Sipon L-22 is an aqueous solution of ammonium lauryl sulfate in 28% solid, manufactured by Rhone-Poulenc Co.

Triton GR-5M is anionic surfactant, manufactured by Union Carbide.

### Properties of the foams and performance of the foam-coated boards

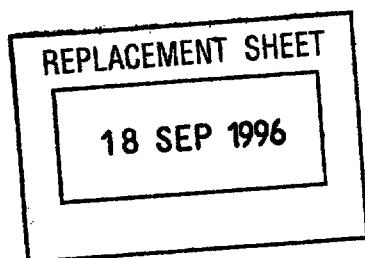
| Examples                       | 6       | 7       | 8       | 9       | 10      |
|--------------------------------|---------|---------|---------|---------|---------|
| Ease of Foaming                | good    | good    | good    | good    | good    |
| Foam Density g/cm <sup>3</sup> | 0.06    | 0.05    | 0.05    | 0.05    | 0.05    |
| Foam Quality                   | uniform | uniform | uniform | uniform | uniform |
| Board released from press      | 8       | 9       | 10      | 10      | 10      |

Press release: 10: automatic release from the hot-press plate

9: momentary sticking automatic release

8: must tap to release from the hot-press

0: cannot be released



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Examples 6 and 7 show that with a foaming agent and insufficient wetting agent, the press release performance was unsatisfactory. Examples 8 and 10 provide satisfactory press release.

Example 11 - 13

Foams in Example 11-13 were prepared in the same way as Example 10 except for changing the foaming agent.

| Examples                                | 11                | 12      | 13      |
|-----------------------------------------|-------------------|---------|---------|
|                                         | (parts by weight) |         |         |
| Pigmented In-press Coating (610-D5-120) | 100               | 100     | 100     |
| Stanfax-320                             | .5                |         |         |
| (foaming agent)                         |                   |         |         |
| Triton W-30                             |                   | .5      |         |
| (foaming agent)                         |                   |         |         |
| Monamid-150 ADD                         |                   |         | .5      |
| (foaming agent)                         |                   |         |         |
| Triton GR-5M                            | .2                | .2      | .2      |
| (wetting agent)                         |                   |         |         |
| Water                                   | 135               | 135     | 135     |
| Ease of Foaming                         | good              | good    | good    |
| Foam density(g/cm <sup>3</sup> )        | 0.06              | 0.05    | 0.10    |
| Foam size                               | uniform           | uniform | uniform |
| Board released from press               | 10                | 10      | 10      |

Stanfax 320 is Ammonium Stearate, manufactured by Adhesive & Chemical Co.

Triton W-30 and Triton GR-5M are Sodium alkylaryl ether sulfate and Dioctyl sodium sulfosuccinate respectively, manufactured by Union Carbide.

Monamid-150 ADD is fatty acid-alkanolamide, manufactured by Mona Industries, Inc.

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Examples 14-16

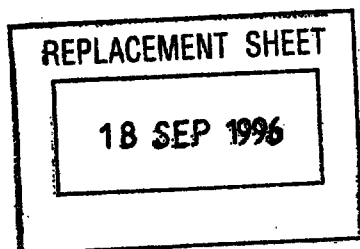
Foams were prepared in the same way as Example 9 except for changing wetting agent.

| Examples                                     | 14      | 15<br>(parts by weight) | 16      |
|----------------------------------------------|---------|-------------------------|---------|
| Pigmented In-press<br>Coating (610-D5-120)   | 100     | 100                     | 100     |
| Sipon L-22<br>(foaming agent)                | 3.0     | 3.0                     | 3.0     |
| Triton X-405 (nonionic)<br>(wetting agent)   | 1.0     |                         |         |
| Triton GR-5M (anionic)<br>(wetting agent)    |         | 1.0                     |         |
| Fluorad FC-135 (cationic)<br>(wetting agent) |         |                         | .3      |
| Ease of foaming                              | good    | good                    | good    |
| Foam density(g/cm <sup>3</sup> )             | 0.05    | 0.04                    | 0.06    |
| Foam size                                    | uniform | uniform                 | uniform |
| Boards released from press                   | 10      | 10                      | 10      |

Triton X-405 is Octyl phenoxy polyethoxy ethanol, manufactured by Union Carbide.

Triton GR-5M is Dioctyl sodium sulfosuccinate, manufactured by Union Carbide.

FC-135 is Fluoroalkyl quaternary ammonium iodide, manufactured by 3M Co.



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Examples 17-20

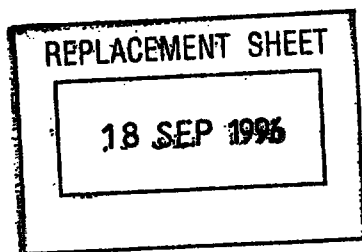
Foams in Examples 17-20 were prepared the same way as Example 15 with different levels of coating on the boards.

| Examples                                             | 17 | 18  | 19  | 20  |
|------------------------------------------------------|----|-----|-----|-----|
| Amount of Add-on<br>dry film thickness<br>0.001 inch | .5 | 1.0 | 2.0 | 4.0 |
| Press released<br>Performance                        | 10 | 10  | 10  | 10  |
| Hiding                                               | 2  | 7   | 10  | 10  |
| Water permeation                                     | 15 | 8   | 6   | 4   |
| Tape adhesion (%)                                    | 85 | 20  | 8   | 0   |

Hiding: 10: perfect hiding, 0 (zero): no hiding

Water permeation: grams per sq inch per 24 hrs. of water pass through the film and retained in boards.

Tape adhesion: percent fiber pulled using 3M, #250 tape with 90 degree to the surface abrupt pull. 0 (zero) percent pull is a perfect adhesion, 100 percent pull is indicative of total failure.



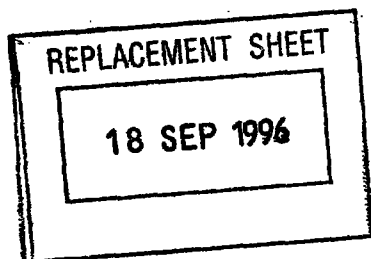
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### Claims

1. A process for preparing wood composition board, comprising (a) foaming by air-whipping an aqueous emulsion polymerized latex composition comprising a polymer of an ethylenically unsaturated monomer which comprises a foaming agent and a wetting agent;  
(b) applying the resultant polymeric foam directly to a wooden mat substrate;  
(c) collapsing the polymeric foam on the wooden mat substrate; and  
(d) hot-pressing the foam-coated wooden mat substrate to cure the polymer.
2. The process according to claim 1, wherein the latex is an acrylic latex polymer.
3. The process according to claims 1 or 2, wherein the latex polymer is foamed from 4 to 50 times of the original volume.
4. The process of claims 2 or 3, wherein the acrylic latex polymer contains from 0.2 to 10 weight percent of water-soluble surfactant foaming agent, based on the total formulation solids.
5. The process of claims 2,3 or 4, wherein the acrylic latex polymer contains a water-soluble organic surfactant foaming agent selected from the group consisting of alkali metal, ammonium and amine salts of higher fatty acids and mixtures thereof.
6. The process of any one of claims 2-5, wherein the acrylic latex polymer contains from 1.0 to 5 weight percent of the water-soluble organic surfactant foaming agent, based on the total formulation solids, and wherein preferably the water-soluble organic surfactant foaming agent is ammonium lauryl sulfate.
7. The process of any one of claims 2-6, wherein the acrylic latex polymer contains a cationic, anionic and nonionic surfactant wetting agent or mixtures thereof; and wherein preferably the cationic surfactant wetting agent is selected from the group consisting of C<sub>12</sub> to C<sub>18</sub> primary, secondary and tertiary amines and salts thereof, diamines, polyamines and their salts, quaternary ammonium salts, polyoxyethylenate amines, quaternized polyoxyethylenate amines and amine oxides; the anionic surfactant wetting agent is selected from the group consisting of alkylaryl sulfonates, disodium mono ester sulfosuccinates, disodium isodecyl sulfosuccinates, disodium ethoxylated



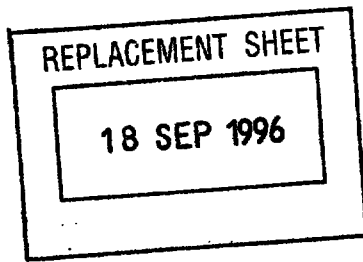
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alcohol half ester of sulfosuccinic acid, disodium ethoxylated nonyl phenol half ester of sulfosuccinates, disodium alkyl amidoethanol sulfosuccinates, disodium alkyl amido polyethoxy sulfosuccinates, disodium alkyl amidoethanol sulfosuccinates, tetrasodium N-(1,2,-dicarboxy-ethyl-)-N-octadecyl sulfosuccinates, disodium N-octadecyl sulfosuccinates, sodium bistridecyl sulfosuccinates, sodium dioctyl sulfosuccinates, sodium dihexyl sulfosuccinates, sodium dioctyl sulfosuccinates, sodium diocyclohexyl sulfosuccinates, sodium diamyl sulfosuccinates, sodium diamyl sulfosuccinates and sodium diisobutyl sulfosuccinates; and the nonionic surfactant wetting agent is selected from the group consisting of polyoxyethylenated alkylphenols, alkylphenol ethoxylates, polyoxyethylenated straight-chain alcohol, amine polyglycol condensate, modified polyethoxy adducts, polyoxyethylenated mercaptans, long chain carboxylic acid esters, modified terminated alkylaryl ether, and alkylpolyether alcohols.

8. The process of claim 7, wherein the acrylic latex polymer contains from 0.2 to 15 weight percent of the anionic, cationic or nonionic surfactant wetting agent, based on the total formulation solids.
9. The process of any one of the preceding claims, wherein the substrate is selected from the group consisting of hardboard, fiberboard, particleboard, waferboard, and strandboard, wet processed hard board, dry processed hardboard, wet/dry processed hardboard, medium density fiber-board and oriented strandboard.
10. A wood composition board comprising an acrylic polymer latex wherein the latex polymer is foamed from 4 to 50 times of the original volume and contains from 0.2 to 10 weight percent of a water-soluble organic surfactant foaming agent and from 0.2 to 15 weight percent of a cationic, anionic or nonionic surfactant wetting agent, or mixtures thereof.



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ABSTRACT

A PROCESS FOR PREPARING WOOD COMPOSITION BOARD

This invention relates to a method for preparing wood composition board, such as hard board, fabricated consolidating fibers or chips under heat and pressure to form an integral board material.

More particularly, this invention relates to an improved method for applying a clear or pigmented prepress coating, also known as a prepress sealer, to the surface of a fibrous mat by converting the prepress sealer into foam prior to subjecting the mat to a temperature and pressure press treatment.

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