United States Patent [19]

Schwarz

[11] **3,900,690**

[45] **Aug. 19, 1975**

[54] **PROCESS FOR THE PRODUCTION OF DIMENSIONALLY STABLE, PLANAR MATERIALS COATED ON ONE SIDE**

[75] Inventor: **Günther Schwarz,** Hiltrup, Germany

[73] Assignee: **Glasurit Werke M. Winkelmann GmbH**

[22] Filed: **May 13, 1974**

[21] Appl. No.: **469,292**

Related U.S. Application Data

[63] Continuation of Ser. No. 264,588, June 20, 1972, abandoned.

[30] **Foreign Application Priority Data**

July 2, 1971 Germany 2132925

[52] **U.S. Cl.** **428/447;** 51/394; 51/399; 427/211; 427/387; 428/453; 428/537

[51] **Int. Cl.²** **B05C 9/04;** B44D 1/02

[58] **Field of Search** ..... 117/68, 68.5, 155 R, 155 L, 117/161 L, 161 LN, 161 ZA; 51/394, 399

[56] **References Cited**

UNITED STATES PATENTS

2,768,906	10/1956	James	117/68
3,163,968	1/1965	Nafus	51/394
3,432,333	3/1969	Hurst	117/68

Primary Examiner—Michael R. Lusignan
Attorney, Agent, or Firm—Gilbert L. Wells

[57] **ABSTRACT**

A method of producing dimensionally stable, coated cellulose containing base materials wherein one side of the material is coated in a conventional manner with the customary inorganic or organic coating agents, such as sodium silicate or synthetic resins optionally containing coloring agents, pigments and/or hard powdered materials, such as emery, quartz sand, pulverized glass, silicon carbide, pumice, aluminum oxides, kieselguhr or films, and the other side of the material is impregnated with a solution of a silicone fluid in one or more organic solvents and the solvents are optionally evaporated.

5 Claims, No Drawings

PROCESS FOR THE PRODUCTION OF DIMENSIONALLY STABLE, PLANAR MATERIALS COATED ON ONE SIDE

CROSS REFERENCES TO RELATED APPLICATIONS

The present application is a Continuation of application Ser. No. 264,588, filed June 20, 1972, and now abandoned. Applicant claims priority under 35 U.S.C. 119 for Application P 21 32 925.9, filed July 2, 1971 in the Patent Office of the Federal Republic of Germany. A copy of the priority document is in the file of application Ser. No. 264,588.

BACKGROUND OF THE INVENTION

This invention relates to a process for the production of dimensionally stable planar materials of a cellulose-containing substance, which are coated on one side and which tend to warp, buckle, or bulge due to characteristic physical properties of the cellulose-containing substance and the coating applied to one side.

Cellulose-containing materials, insofar as they are coated on one side, are not dimensionally stable, i.e., these materials warp torsionally or are distorted tensionally, planar materials bulge or are bent to a greater or lesser extent depending on the thickness of the sheet. Thus, for example, paper webs, cardboards, hardboard sheets of wood pulp or some other cellulose-containing material, or vulcanized fiberboard sheets which are unilaterally coated have the disadvantageous property of warping to differently strong degrees, depending on the amount of atmospheric humidity. This troublesome, undesirable phenomenon makes it difficult in most cases to use, manipulate, and completely exploit, for example, abrasive belts, emery paper, or abrasive papers, as well as self-adhesive films or self-adhesive wallpapers. Hardboards made from wood pulp or cellulose compounds are used in furniture manufacture, for house trailers, and for the interior outfitting of automobile bodies. They furthermore serve as building components in prefabricated house construction. With the use of hardboards coated on one side, the distortion behavior can cause warping by tensional forces, and for example, can render furniture or house trailers manufactured therefrom unattractive after a short period of time. Also, fastening operations as employed in building construction, for example gluing, affixing, or nailing, can be carried out when the hardboard sheets coated on one side are deformed, only at increased expense and by special procedures, without being able to ensure durability. The only possible countermeasure against warping has heretofore been to coat these sheets or papers symmetrically on both sides in the same manner. However, this can almost never be accomplished in practice.

SUMMARY OF THE INVENTION

It is an object of the present invention to avoid these disadvantageous properties of the coated materials made of cellulose-containing substances so that they no longer occur, and the materials remain dimensionally stable.

This problem has been solved, surprisingly, by a process for the production of dimensionally stable, coated, planar materials of cellulose-containing substances which is characterized in that one side of the material

is conventionally coated with the customary inorganic or organic coating agents, such as, for example, sodium silicate or synthetic resins which can contain coloring substances, pigments and/or hard powdered materials of various degrees of fineness, such as emery, quartz sand, pulverized glass, silicon carbide, pumice, aluminum oxides, kieselguhr, or film coated, whereas the other side of the material is treated with a solution of a silicone fluid in one or more organic solvents so that the silicone fluid penetrates into the pores of the material and the solvent is optionally evaporated.

Solvents which are hydrophilic are preferred. They are used by themselves or in a mixture with other organic solvents.

The process is carried out so that 1–30 g./m^2 of a 0.1–50 percent by weight, preferably 3–10 percent by weight, silicone solution is applied.

The application of the silicone solution takes place directly prior to or after the application of the principal coating on the other side and the curing thereof, prior to or after the rewetting of the material.

By the terms "dimensionally stable" according to the present invention means that the materials of cellulose-containing substances do not warp torsionally or become distorted by tensile effects; that they do not bulge, bend, or become distorted by bending effects, or are deformed in any other manner, as soon as they carry a coating on one side.

The after-treatment of the uncoated side of the materials according to the present invention, which is simple to execute, surprisingly yielded a complete, lasting elimination of the deformational phenomena normally present. Actually, an increase in warping or bulging was, on the contrary, to be expected, since silicone fluids, being lubricating and smoothing substances, can affect the internal, characteristic properties of the porous, cellulose-containing material along the lines of a plasticizer, and thus increase the difference in the physical behavior of the coating with respect to the material substrate, which difference is responsible for warping.

Materials coated on one side, such as abrasive belts, emery papers, and abrasive paper, as well as hardboard sheets, retained their shape when treated according to the process of the present invention and could be used and processed substantially more readily and trouble-free. Also storage tests under various conditions and over rather long periods of time showed the coated materials to be permanently dimensionally stable, without any warping and changes otherwise occurring in untreated materials coated on one side. It has furthermore been found that, for example, the surface becomes essentially smoother and more supple.

This unexpectedly advantageous effect is attained by the application of silicone fluids in the form of a solution thereof in organic solvents to the uncated side of the materials of cellulose-containing substances.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Suitable silicone fluids are methyl siloxanes, methylpolysiloxanes, methylphenyl-siloxanes, and methylphenylpolysiloxanes, wherein organosubstituents of the same type or of different types are present, such as, for example, products with ethyl and methyl hydrogen groups, as well as such organofunctional groups as, for example, β-cyanoethyl, γ-cyanopropyl, γ-trifluoropropyl, δ-aminobutyl, and tetrachlorophenyl groups.

Silicone fluids are obtained according to conventional methods by the hydrolysis of chlorosilanes and subsequent condensation and/or polymerization to cyclic or linear polysiloxanes. Silicone fluids are clear, colorless, neutral, and almost odorless fluids exhibiting viscosities of between 0.65 and 1,000,000 centistokes and a molecular weight of between 600 and 400,000. In technical literature, these compounds have been described in detail. Thus, reference is had to the book "Einfuehrung in die Chemie der Silikone" [Introduction to Silicone Chemistryl] by Eugene G. Rochow, publishers Chemie G.m.b.H., Weinheim/Bergstrasse, 1952; and "Ullmanns Encyklopaedie der technischen Chemie" [Ullmann's Encyclopedia of Technical Chemistry], vol. 15, **1964,** pp. 778–782.

Silicone fluids are also disclosed in the Kirk-Othmer "Encyclopedia of Chemical Technology", 2nd Edition, Vol. 18, (1969) pages 237–241. The preparation of dimethyl silicone fluids is disclosed at page 237, methyl phenyl silicone fluids are disclosed at p. 241 along with chlorinated phenyl groups attached to silicone, methyl trifluoropropyl silicone fluid and methyl alkyl silicone fluids and Table 7 on page 238 discloses the properties of Silicone Fluids. U.S. Pat. Nos. 3,179,619 and 3,050,492 cited in Kirk-Othmer disclose homopolymers and copolymers with dimethyl silicone.

The disclosures of these literature and patent references to silicone fluids are incorporated herein.

The silicone fluids are soluble in many organic solvents, such as aliphatic hydrocarbons, aromatic hydrocarbons, esters, furthermore dimethyl sulfoxide, and dimethylformamide. Preferably suitable are hydrophilic solvents, such as alcohols, especially ethyl, propyl, butyl, isopropyl, isobutyl alcohol, furthermore glycols, glycol esters, glycol ethers, and glycerin. Examples in this connection are methyl, ethyl, butyl, isobutyl, propyl, and amyl glycol; methyl glycol esters, ethyl glycol esters, butyl glycol esters, methyl glycol acetate, ethyl glycol acetate, ethylene glycol, propylene glycol, butyl diglycol, and other polyglycols. The solvents can be used individually or in mixtures with one another.

The application of the silicone fluid solution to the uncoated side of the materials is effected by means of the usual methods, such as, for example, brushing, casting, spraying, or rolling. It is particularly advantageous to use those silicone fluid solutions which contain between about 0.1 and 50 percent by weight, preferably, however, between about 3 and 10 percent by weight of silicone fluid and 90–97 percent by weight solvent.

The process of this invention is applicable to all materials made of cellulose-containing substances which are coated on one side. Materials made from cellulose-containing substances are intended to mean all materials which contain cellulose-containing matter on the outer surface of the material. The materials can have any desired shape, but are preferably planar materials, such as, for example, sheets, panels, films which can be linear or curved. Among the suitable materials are cardboard, papers, films of cellulose material, hardboards, composite sheets, plywood panels, and vulcanized fiber.

The materials are coated on one side; in other words, they are covered with a hardened layer which provides an airtight seal against the surrounding atmosphere for the material of cellulose-containing matter. Thereby, the cellulose-containing substance can breathe, and the moisture exchange at varying atmospheric humidities can take place, only toward the uncoated side.

The materials of cellulose-containing matter can be coated on one side with any desired layer which ensures an airtight seal for this side from the surrounding atmosphere. These layers can be of an inorganic or organic character. Thus, suitable substances are, for example, synthetic resins, such as urea-formaldehyde resins, melamine-formaldehyde resins, or phenol-formaldehyde resins, alkyd resins, polyester resins, polyamide resins, epoxy compounds, polyurethanes, polysulfides, polybutadiene, chlorinated rubber, polyethylene, polypropylene, and many others.

It is furthermore possible to embed into the synthetic resins coloring agents, hard powders of various degrees of fineness, and pigments, such as, for example, emery, quartz sand, powdered glass, carbides, silicon carbide, pumice, aluminum oxides, kieselguhr, polishing agents, etc.

The coating can furthermore consist of an inorganic material, e.g. sodium silicate.

The production of such coatings does not pertain to the subject matter of the present application. They can be applied in a conventional manner by rolling, spraying, calendering the coating agents from solutions in organic solvents or from aqueous dispersions. It is also possible to press films against the substrate. Thereafter, the coating can be dried and cured in the usual manner. The curing process is omitted in the manufacture of self-adhesive films. After the coated side has been cured by baking at elevated temperatures in the usual manner, the material of cellulose-containing matter contains only minor amounts of moisture. In order to restore the equilibrium with respect to the atmospheric humidity, a rewetting is generally carried out after the curing procedure, by spraying the uncoated side with water.

According to the process of the present invention, the silicone fluid solution is applied prior to or after the curing process and prior to or after the rewetting step.

The materials coated on one side and obtained according to the process of the present invention are required for a great variety of fields of application. Thus, it is, above all, possible to produce abrasive papers and abrasive belts in a dimensionally stable form. Also hardboards and plywood panels can find a broadened application in the furniture, house trailer, and building industries. Also vulcanized fiberboards remain dimensionally stable. Further fields of use are the treatment of self-adhesive films, self-adhesive wallpapers, as well as postage stamps.

The following examples are to explain the process of this invention without limiting same. All percentage data relate to percent by weight and all parts are parts by weight.

EXAMPLE 1

An abrasive belt, coated on one side with a phenolic resin and the usual abrasive agents, is treated on the uncoated side with a solution of 5 parts by weight of phenyl methyl siloxane (having the trade name silicone oil PL from Bayer AG, Leverkusen, Germany) in butyl glycol. With the aid of a roll, between 10 and 15 g./m^2 (grams per square meter) is rolled onto the substrate. After the solvent has been evaporated and the belt has dried, a supple, smooth, distortion-free abrasive belt is obtained which permanently retains its shape.

EXAMPLE 2

A hardboard panel, covered on one side with a varnish coat of an acid-curing varnish with a layer thickness of 50–100 micron, is treated on the backside by rolling thereonto a solution of 6 parts of a methylpolysiloxane (having the tradename silicone oil M from Bayer AG, Leverkusen, Germany) in a mixture of butyl glycol and glycerin (80:20). In this way, 15–17 g./m² is applied. A hardboard panel is thus obtained which retains its smooth form and does not warp even at extreme atmospheric humidity values.

EXAMPLE 3

A paper web coated with a phenolic resin wherein emery is embedded and exhibiting a thickness of 1.2 mm. is sprayed on the uncoated side with a solution of 5 parts by weight of silicone oil M (as described in example 2) in a mixture of 60 parts of toluene, 15 parts of monoglycol butyl ether, and 15 parts of isobutanol, so that about 15–17 g./m² is thus applied. After drying for 10 hours at 60°C in a drying chamber, the dimensional stability was retained without change after a storage period of 6 weeks at a relative atmospheric humidity of 80 percent, whereas an identical sample treated only with the solvent mixture without the silicone fluid in the same manner exhibited strong warpage after a short storage period of 20 hours.

EXAMPLE 4

A solution of 5 parts by weight of silicone oil PL (as described in example 1) in a mixture of 90 percent of mineral spirit and 10 percent of butanol is rolled onto the backside of a hardboard panel provided with an epoxy coating, immediately after baking the epoxy coating. After drying in air, the uncoated backside is sprayed with water. About 14 g./m² of the silicone fluid solution is applied. The thus-treated hardboard panel retains it smooth, dimensionally stable shape and shows no tendency toward bulging.

EXAMPLE 5

Papers coated on one side, e.g. postage stamps or wallpapers wherein the coating consists of a glue film are treated, on the uncoated side

a. prior to the glue application,

b. simultaneously with the glue application, or

c. after the glue application

with an 8 percent solution of a methylpolysiloxane (having the tradename silicone oil M from Bayer AG, Leverkusen, Germany) in butyl diglycol by spreading. The amount of silicone oil solution applied depends on the weight of the paper and on the compression of the paper and amounts, on the average, to between 5 and 30 g./m². After drying, gummed papers (postage stamps or wallpapers) are obtained which neither bulge nor warp.

EXAMPLE 6

A self-adhesive surfacing or decorative sheet wherein the substrate consists of papers impregnated with urea-formaldehyde or melamine-formaldehyde or phenol-formaldehyde resins and the self-adhesive coating consits of melamine resin or urea resin, is treated with the silicone fluid solution as indicated in Example 1. After drying, the self-adhesive foils do not warp and retain their smooth shape on a permanent basis.

EXAMPLE 7

For comparison purposes, an abrasive belt coated, as described in Example 1, on one side with a phenolic resin and the usual abrasive agents, is treated on the uncoated side by rolling with a mixture of butyl glycol and glycerin (80:20). As in Example 1, 10–15 g./m² is applied by rolling. The abrasive belt obtained after evaporation of the solvent retains its smooth shape only temporarily and is warped again after a short period of time.

I claim:

1. A method for producing a dimensionally stable porous cellulosic substrate by impregnating the uncoated side opposite to that bearing a moistureproof impermeable surface coating with silicone fluids, and drying said coating, the improvement comprising applying to said uncoated side of said substrate a solution containing 90 – 97 percent by weight of a solvent selected from the group consisting of organic hydrophilic solvents or solvents containing not less than 10 percent of said hydrophilic solvents and 3 – 10 percent by weight silicone fluid having a viscosity of 0.65 – 1,000,000 centistokes and a molecular weight between about 600 – 400,000.

2. The method of claim **1,** wherein said impermeable surface coating is selected from the group consisting of sodium silicate and synthetic resins.

3. The method of claim **1,** wherein said impermeable surface coating is a pressed film.

4. The method of claim **1,** wherein said base sheet material is exposed to moisture prior to the application of said silicone fluid.

5. The product obtained by the method of claim **1.**

* * * * *