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Ervin et al.

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[54] **CARPET AND PREPARATION THEREOF**

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Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 199,807, Nov. 17, 1971, abandoned.

[52] **U.S. Cl.** **161/64,** 161/67, 156/72, 156/79

[51] **Int. Cl.** **D04h 11/00**

[58] **Field of Search** 156/72, 79; 161/64, 67

[56] **References Cited**

UNITED STATES PATENTS

3,585,099	6/1971	Van Buskirk	161/67

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[57] **ABSTRACT**

A highly satisfactory carpet is prepared by applying to the back of a filamentary carpet a mixture of expandable microspheres and a film forming binder, drying and foaming the mixture on the carpet back. The resultant backed carpet shows excellent resiliency and resistance to permanent set.

7 Claims, No Drawings

CARPET AND PREPARATION THEREOF

This application is a continuation-in-part of our copending application Ser. No. 199,807, filed Nov. 17, 1971, now abandoned.

This invention relates to an improved carpet and the preparation thereof.

Many carpets are prepared which consist of a low cost backing material such as jute or the like through which filaments are positioned to provide a plurality of tufts extending on one side thereof to form the nap of the carpet. Such carpets are often installed over a resilient backing or an integral resilient backing such as a latex foam is applied thereto. Oftentimes rubber or latex foam resilient backing adhered to the scrim or back of the carpet is of very low strength and oftentimes of minimal resiliency.

It is an object of the present invention to provide an improved backed carpet and to provide an improved method for the preparation of such carpet.

It would be desirable if there were available an improved method for the preparation of carpet which permitted the rapid application and formation of a resilient backing.

These benefits and other advantages are achieved in accordance with the present invention in an improved carpet comprising a supporting scrim having extending from at least one side thereof a nap composed of a plurality of filaments, a resilient backing adhered remote from said extending filaments, the resilient backing comprising a plurality of synthetic resinous hollow gas-filled microspheres, the hollow microspheres having a polymer shell, the polymer shell having a glass temperature (Tg) of at least 50°C. and a bulk density of about 0.25 to about 5 pounds per cubic foot, the microspheres being contained in a synthetic resinous thermoplastic matrix having a glass transition temperature of from about −50°C. to about +20°C.

Also contemplated within the scope of the present invention is a method for the preparation of a backed carpet, the steps of the method comprising providing a carpet having a plurality of filaments extending from at least one side thereof, a supporting scrim supporting the filaments, applying to the carpet remote from said extending filaments a foam forming composition comprising in intimate admixture an aqueous dispersion containing from about 15 to 85 parts by weight of a film forming synthetic resinous latex binder and from about 85 to about 15 parts by weight of expandable synthetic resinous microspheres, the expandable microspheres having a synthetic resinous thermoplastic shell having symmetrically encapsulated therein as a distinct and separate phase a volatile fluid raising agent, heating the dispersion to a temperature sufficiently high to remove water therefrom and cause the latex to form a matrix about the expandable microspheres, and heating to a temperature sufficient to cause expansion of the microspheres to form a plurality of gas-filled monocellular thermoplastic shells.

A wide variety of microspheres may be employed in the practice of the present invention. The particular chemical composition of the microsphere shell and the fluid foaming agent within is not critical. The critical factor in the microspheres is the glass transition at temperatures of the polymer forming the shell. Many expandable synthetic resinous microspheres are known and such microspheres and the preparation thereof are

described in U.S. Pat. application Ser. No. 634,691, now U.S. Pat. No. 3,615,972. Such microspheres and their preparation are also disclosed in Canadian Patent 752,451 and British Patent 1,044,680. Typical expandable microsphere compositions which are useful are microspheres having a polymer shell of 60 parts by weight styrene and 40 parts by weight acrylonitrile containing from about 15 to 20 weight percent isobutane as the volatile fluid foaming agent. Other useful microsphere compositions are methylmethacrylate/acrylonitrile 95:5 parts by weight with neopentane; polymethylmethacrylate with neopentane and polyethylmethacrylate with neopentane.

A wide variety of synthetic resinous latex materials may be employed as the binder or film forming latex in the present invention. The precise chemical composition of the polymer of the latex is not critical. The polymer should be water insoluble and have a glass transition temperature between about −50°C. and +20°C., and should be film forming at a temperature at least about 10°C. below the temperature at which the expandable microspheres expand, and beneficially, about 30°C. Typical latex polymers which are suitable for the practice of the present invention include latex polymers of 60 weight percent styrene, 40 weight percent butadiene; 67 weight percent methylmethacrylate, 33 weight percent ethyl acrylate; 85 percent vinylidene chloride, 5 percent ethyl acrylate; 10 percent butyl acrylate; 70 percent polybutadiene, 30 percent acrylonitrile; 80 weight percent vinyl acetate, 20 weight percent diethylmaleate.

Other components may also be incorporated within the aqueous dispersions such as dyes, fillers, pigments, stabilizers for both light and heat, flame retarding agents and other additives commonly employed with aqueous latex dispersions and utilized with benefit.

Dispersions for the practice of the present invention are readily prepared employing conventional latex formulating procedures, as the expandable synthetic resinous microspheres are often available as a wet filter cake containing from about 15 to about 40 weight percent water. No difficulty is encountered in admixing the latex and the microspheres. Generally for most coating operations it is desirable to incorporate within the composition a thickening agent such as the thickening or viscosity controlling agents conventionally used with latex coatings which include a wide variety of water soluble polymers including the sodium salt of polyacrylic acid, hydroxypropyl carbonate, cellulose, lecithin, gum agar and the like. As an alternate to thickening the latex, a number of thin coats may be applied, dried and subsequently foamed. Beneficially for most applications it is desirable to provide an aqueous dispersion having a viscosity between about 5 and 10 thousand centipoise. The coating composition may be applied by any conventional coating procedure including spraying, rolling, doctoring, roll coating and the like. Drying of the coating beneficially may be accomplished prior to foaming, or drying and foaming accomplished simultaneously. Such drying and foaming conventionally may be accomplished by circulating heated air, infrared heat and like heating methods well known to the art. Beneficially in some instances it is desirable to accomplish the foaming between a pair of generally adjacent parallel belts in order to obtain a product which has a constant thickness if control of coating weight is less than desired. Alternately, the coating may be pre-

foamed; that is, foamed without mechanical restriction and passed under a hot doctor roll which may have a temperature of from about 200° to 400°C. which serves to collapse undesirable protruding portions of the foam backing.

Employing the present invention, a resilient backing is made integral with the carpet with a minimal necessity of process condition control, labor materials and the like. The resultant carpets exhibit excellent resiliency and the backings are generally of relatively high strength.

The present invention is further illustrated but not limited by the following examples:

EXAMPLE 1

A coating formulation is prepared by mixing the following ingredients in the order given with gentle agitation at room temperature: a latex of 54.9 percent solids (the latex polymer is a copolymer of 60 parts by weight styrene and 40 parts by weight butadiene (Tg −10°C.); 145.8 parts of the latex are employed); 27.8 parts water; a 10 weight percent solution of sodium lauryl sulfate, 2 parts by weight; expandable microspheres having a polymer shell of a polymer of 49 parts by weight styrene, 32 parts by weight acrylonitrile (Tg 110°C.) and containing encapsulated therein 19 weight percent neopentane, based on the weight of the polymer shell; 20 parts by weight of the microspheres are used. Twelve parts by weight of an aqueous solution of the sodium salt of polyacrylic acid, 11.2 percent solids, are employed. The viscosity of the resultant solution is about 7500 centipoise. A 6 inch square of tufted polypropylene carpet having polypropylene scrim is coated with 20 grams of the foregoing formulation employing a roller. The coating is air dried and subsequently placed between spaced platens in a press. A metal sheet is disposed between the coating and the press platen and an asbestos pad is placed between the pile side of the carpet. After 2.5 minutes, the coated samples are removed from the press and have a foamed coating thereon about 0.15 inch thick of expanded microsphere polymer shells having a glass temperature of >50°C. and a bulk density within the range of 0.25 to 5 pounds per cubic foot. The backed carpet is resilient, resists permanent set at ambient temperatures and is very acceptable for floor covering applications.

EXAMPLE 2

A coating formulation is prepared employing 139 parts by weight of the styrene/butadiene latex of Example 1 but with 57.5 percent solids; 34 parts by weight water; 2 parts by weight of a 10 percent aqueous solution of sodium lauryl sulfate; 20 parts by weight of expandable microspheres of Example 1; 5 parts by weight of the polyacrylic acid solution of Example 1. The weight ratio of latex solids to microspheres is 4:1. The viscosity of the solution is about 8500 centipoise. Twenty grams of the foregoing coating dispersion are applied to a 6 inch square of polypropylene carpet having polypropylene scrim. The coated carpet is dried in a forced air oven at 240°F. and foamed in a platen press at 135°C. as done in Example 1. The resultant sample shows good flexibility, resistance to significant permanent set at ambient temperatures, and resiliency with no tendency for the coating to flake.

EXAMPLE 3

A 20 gram portion of the coating formulation of Example 2 is applied to a tufted polyethylene carpet with a polyethylene scrim and dried and foamed in accordance with Example 2. The resultant sample shows good flexibility, resistance to significant permanent set at ambient temperatures, and resiliency with no tendency for the coating to flake.

EXAMPLE 4

The procedure of Example 2 is repeated with the exception that a tufted wool carpet having a jute scrim is employed. The backing shows good flexibility, resilience, resistance to permanent set at ambient temperatures, and resistance to flaking.

EXAMPLE 5

The procedure of Example 2 is repeated with the exception that a tufted filament nylon carpet with a polypropylene scrim is employed. Similar results are obtained.

EXAMPLE 6

The procedure of Example 2 is repeated with the exception that a tufted nylon carpet with jute scrim is employed. Similar results are obtained.

EXAMPLE 7

The procedure of Example 2 is repeated with the exception that a tufted acrylic carpet is employed having jute scrim. Similar results are obtained.

EXAMPLE 8

A coating formulation is prepared employing 170 parts by weight of a latex which is a polymer of 85 percent vinylidene chloride, 10 percent butyl acrylate and 5 percent acrylonitrile (Tg −30°C); 8 parts by weight water; 2 parts by weight of a 10 percent solution of sodium lauryl sulfate; 15 parts by weight of expandable microspheres of Example 1, and 5 parts by weight of the polyacrylic acid solution employed in Example 1. The weight ratio of latex solids to microspheres is 85:15, and the resultant coating formulation has a viscosity of about 7500 centipoise. A six inch square of tufted nylon carpet having a jute scrim is coated with 20 grams of the formulation and foamed in the manner of Example 2. Similar results are obtained.

EXAMPLE 9

A coating formulation is prepared employing the following ingredients: 160 parts by weight of a 50 percent solids latex of a polymer of 40 percent isobutylacrylate and 60 percent vinyl acetate (Tg 9°C.); 13 parts by weight water; 2 parts by weight of a 10 percent solution of sodium lauryl sulfate; 20 parts by weight of expandable microspheres having a polymer shell of 80 percent methylmethacrylate, 20 percent methyl acrylate (Tg 80°C.) and containing encapsulated therein 33 parts by weight neopentane; 5 parts by weight of the sodium salt of polyacrylic acid. The weight ratio of latex solids to microspheres is 4:1. Twenty grams of the formulation are applied to the back of a 6 inch square of tufted polypropylene carpet having a polypropylene scrim. Results similar to those of Example 2 are obtained.

EXAMPLE 10

The procedure of Example 9 is repeated with the exception that the following coating composition is employed: 160 parts by weight of a 50 percent solids latex of a polymer of 80 weight percent ethyl acrylate and 20 weight percent styrene (Tg −3°C.); 13 parts by weight water; 2 parts by weight of a 10 percent solution of sodium lauryl sulfate; 20 parts by weight of expandable synthetic resinous microspheres having a polymer shell of a polymer of 94.5 percent methylmethacrylate and 5.5 percent acrylonitrile (Tg 112°C.). The microspheres contain 35 percent neopentane based on the weight of the polymer shell; 5 percent of the sodium salt of polyacrylic acid. The latex solid to microsphere ratio is 4:1. The resultant composition is foamed in the manner of Example 9 and commensurate results are obtained.

EXAMPLE 11

The procedure of Example 1 is repeated employing the following coating composition: 160 parts by weight of a 50 percent solids latex of a polymer of 67 percent by weight butyl acrylate and 33 percent acrylonitrile (Tg −40°C.); 13 parts by weight water; 2 parts by weight of a 10 percent solution of sodium lauryl sulfate; 20 parts by weight of expandable synthetic resinous microspheres having a polymer shell of one part by weight methyl methacrylate and one part by weight methyl methacrylate and one part by weight methyl acrylate (Tg 51°C.). The expandable microspheres contain 31.5 percent neopentane based on the weight of the polymer shell; 5 parts by weight of the polyacrylic acid solution of Example 1; the weight ratio of latex solids to microspheres is 80:20. Commensurate results are obtained.

In a manner similar to the foregoing examples, a wide variety of carpets are provided with resilient backings in accordance with the present invention.

As is apparent from the foregoing specification, the present invention is susceptible of being embodied with various alterations and modifications which may differ particularly from those that have been described in the preceding specification and description. For this reason, it is to be fully understood that all of the foregoing is intended to be merely illustrative and is not to be construed or interpreted as being restrictive or otherwise limiting of the present invention.

What is claimed is:

1. An improved carpet comprising

a supporting scrim having extending from at least one side thereof

a nap composed of a plurality of filaments,

a resilient backing adhered remote from said extending filaments, the resilient backing comprising

a plurality of synthetic resinous hollow gas-filled microspheres, the hollow microspheres having a polymer shell, the polymer shell having a glass temperature of at least 50°C. and a bulk density of about 0.25 to about 5 pounds per cubic foot, the microspheres being contained in

a synthetic resinous thermoplastic matrix having a glass transition temperature of from about −50°C. to about +20°C.

2. The carpet of claim **1** wherein the polymer shell of the hollow microsphere is a copolymer of styrene and acrylonitrile.

3. The carpet of claim **1** wherein the shells are a copolymer of about 60 parts by weight styrene and about 40 parts by weight acrylonitrile.

4. The carpet of claim **1** wherein the matrix is a polymer of styrene and butadiene.

5. A method for the preparation of a backed carpet, the steps of the method comprising

providing a carpet having a plurality of filaments extending from at least one side thereof, a supporting scrim supporting the filaments,

applying to the carpet remote from said extending filaments a foam forming composition comprising in intimate admixture an aqueous dispersion containing from about 15 to 85 parts by weight of a film forming synthetic resinous latex binder and from about 85 to about 15 parts by weight of expandable synthetic resinous microspheres, the expandable microspheres having a synthetic resinous thermoplastic shell having generally symmetrically encapsulated therein as a distinct and separate phase a volatile fluid raising agent,

heating the dispersion to a temperature sufficiently high to remove water therefrom and cause the latex to form a matrix about the expandable microspheres, and

heating to a temperature sufficient to cause expansion of the microspheres to form a plurality of gas-filled monocellular thermosplastic shells.

6. The method of claim **5** wherein the latex binder is a copolymer of styrene and butadiene.

7. The method of claim **5** wherein the expandable microspheres have a shell of a styrene-acrylonitrile polymer.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,819,463 Dated June 25, 1974

Inventor(s) Gary D. Ervin et al.

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 5, lines 29 to 30, delete "and one part by weight methyl methacrylate".

Signed and sealed this 8th day of October 1974.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

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