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RESIN TREATED PILE FLOOR COVERINGS

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ABSTRACT OF THE DISCLOSURE

A pile fabric floor covering is treated with a liquid resin for example as a solution or dispersion and the resin is solidified so as to bond the fibres in the pile together. The amount of resin deposited on the pile is at least 5 percent by weight based on the weight of the pile fabric.

The floor coverings commonly employed for internal use vary widely from hard floor coverings such as, for example, tiles or wood blocks to soft coverings such as carpets. Hard floor coverings usually have the advantage of outstanding durability compared with other types of coverings. They do not, however, possess the properties of resilience and thermal insulation as do carpets. It is desirable that a floor covering should be provided combining the outstanding and beneficial properties of hard floor coverings and those of carpets in a single product, whilst having a pleasing appearance and being inexpensive to manufacture.

According to the present invention a floor covering comprises a pile fabric, the pile fibres of which are bonded together with at least 5 percent by weight on the weight of the pile fabric of a resin.

The invention also includes a process for making the novel floor covering described above comprising impregnating the pile fibres of a pile fabric with at least 5 percent by weight on the weight of the pile fabric of a resin and bonding together the adjacent pile fibre bearing the resin.

The pile fabrics which form the basis of the floor coverings may be of tufted or woven construction having cut or uncut pile fibres. It is preferred, however, for reasons of economy, that the fibres should have short piles of high tuft density. A wide variety of fibres of natural or synthetic origin may be employed in the pile fabrics in the pile and in the backing fabric. Examples of suitable pile fibres are wool, viscose rayon, polyamide and acrylic fibres, and mixtures of such fibres. The fibres used should, of course, be of a type which is largely unaffected by the temperatures employed if the resin used is heat cured, as explained hereafter.

The resins which may be employed in the process of this invention are polymeric materials which bond together the adjacent pile fibres to which they are applied. Bonding may be accomplished with or without a curing treatment which normally involves the application of heat to effect further polymerisation or crosslinking of the resin. Where high temperatures are employed at some stage in the process, they should obviously be not so high as to affect deleteriously the pile fibres being bonded together or the backing fabric.

The resin is preferably applied to the pile fibres in liquid form either undiluted or as a solution, suspension. or emulsion in a liquid medium such as water. Many suitable resins are commercially available in the form of 30 to 50 percent by weight emulsions in water which may be further diluted. Impregnation in liquid form is readily accomplished by spraying, padding, dipping or foaming

from a lick roller. Where the resin is applied as a solution, suspension or emulsion, the liquid medium is subsequently removed, for example, by evaporation. In another method of application, the resin is applied in melt form and is subsequently cooled.

It is possible to treat the pile fabric with materials other than the resin before or after the impregnation stage, provided these do not prevent the bonding action of the resin. The impregnation may be performed in more than one stage if desired; if, however, a catalyst is employed for catalysing polymerisation or crosslinking of the resin, this will usually be applied to the pile fabric simultaneously with the impregnation with the resin. In yet another method of applying the resin to the pile fibres, the resin is formed in situ by reaction between two or more ingredients after they have been applied to the fibres either separately or, preferably, shortly after mixing them. A resin which may be conveniently formed in this manner is a polyurethane (also known as a polyisocyanate) resin. In a still further method of impregnation of the pile fibres, the resin is applied as a powder which is then melted to bond the fibres.

The resins employed should preferably be deformable to the extent that the property of resilience is not removed entirely from the pile fabrics in the process. We have found self-crosslinking acrylic resins, especially those containing a major proportion of units derived from an acrylic ester with minor proportions of units derived from substituted acrylic acids and/or substituted alkylolacrylamide, to be particularly suitable for use in our process. Examples of other suitable resins are polyvinyl alcohol and polyvinyl chloride. Other resins which may be used are elastomeric, natural or synthetic resins. Additionally, the resin may usefully be an insolubilised protein for example insolubilised gelatine. The application of an insolubilised protein is readily accomplished by impregnating the pile fabric with a protein and a hardening agent for the protein, for example formaldehyde. A humectant to prevent the protein hardening excessively and becoming brittle is preferably also used.

The amount of resin employed in relation to the weight of the pile fabric depends on the particular properties desired in the product. Whilst it is required to use at least 5 percent by weight of resin on the weight of the pile fabric, up to as much as 100 percent, or even higher, of resin may be used. Generally speaking, the higher amounts of resin are employed where the floor coverings are for industrial application, for which purpose the improvement in the wearing properties, particularly the appearance retention, permanence of resilience and durability of the floor coverings, which accompanies the increase of resin content, outweighs the loss of handle and initial appearance. Normally, for industrial application, the amount of resin will be within the range of from about 15 to 100 percent by weight. For uses where especially high durability is not so important and good handle and appearance are wanted, as in domestic use, the pile fabrics are usually impregnated with from 5 to 40 percent, preferably from 15 to 40 percent, by weight on the weight of the pile fabric.

The degree of bonding of the adjacent pile fibres is affected by the amount of resin applied. Generally speaking, the greater the degree of bonding, the more durable the product but as the degree of bonding increases the resemblance of the product to a conventional unbonded carpet decreases. Where larger amounts of resin are used it is found that adjacent pile tufts may be bonded together. The rate of drying also influences the degree of adhesion of adjacent pile tufts, it having been found that slow drying enables greater amounts of resin to be used without excessive loss of appearance through pile tuft adhesion.

Where the resin is applied to the pile fabric in liquid form, additional material, such as filters, for example white clay or thermoplastic powders, dyes or pigments, softening agents, soil retardants, fire retardants or germicides, may be present in the liquid besides the resin. Where a filler is employed, the amount used will normally be of the order of, say, 5 percent by weight on the weight of pile fabric.

The appearance and physical properties of the floor coverings according to the invention may be considerably changed if desired, by applying to the pile fabrics inert particulate materials, as well as resins. Impregation of the pile fabric with the resin may be accomplished before, after or simultaneously with application of the particulate material to effect bonding of adjacent pile fibres and adhesion of the particulate material to the pile fibres. It is preferred, however, that the particulate material should be applied to the pile fabric together with the resin, or, less desirably, before application of the resin rather than after the resin has been applied. The particles may, by the preferred sequence of application, be more firmly attached to the pile fibres.

We include in the term "particulate material" material which consists of particles, preferably generally spherical, with the average maximum dimension within the range of from about 0.25 mm. to about 1.5 mm. Normally, all the particles are of substantially the same size but this is not essential. Where the particles have a range of diameters, the great majority of the particles should preferably be within the size limits stated above. The particulate material may be of natural origin, for example sand, or it may be of synthetic origin, for example glass beads. Furthermore, the material may take any color desired or it may be colorless. If the particulate material is reflective, for example if it is glass beads or ballotini, the products exhibit a degree of reflectancy which is unexpected in a pile fabric. Where, as is usual, the particulate material is inorganic and is hard, the floor coverings are very durable and generally exhibit enhanced fire-resistance compared with similar products without the particulate material.

The amounts of particulate material and resin may be varied widely according to the characteristics of the impregnants and the treated pile fabrics. Generally from about 2 to about 10 percent by weight of particulate material with at least about 25 percent, preferably between say 50 and 100 percent, by weight of resin on the weight of pile fabric is used.

The pile fabric may incorporate other features besides the actual pile itself and the backing fabric. A resilient layer of, for example, foam rubber or polyurethane foam, may thus be provided attached to either face of the backing fabric. The impregnated pile fabrics may also be subjected to mechanical treatments before or simultaneously with the bonding by the resin. On treatment of this type involves passing the fabric between heated calender rollers to compress the pile and bond the fibres simultaneously.

The principal advantage of the floor coverings according to this invention is that they can be made cheaply in comparison with a great many other floor coverings whilst being extremely durable. Besides possessing the property of extreme durability, the resin-bonded pile fabrics of this invention retain to an unexpected extent the advantageous properties of conventional unbonded carpets, particularly a desirable degree of thermal insulation and resilience. Additionally, the floor coverings are not noisy to walk on.

The product of this invention is essentially a floor convering but not withstanding the use of the term "floor covering" it is possible to use the resin-impregnated pile fabrics in places other than on floors. Particularly, they may be used as decorative wall coverings and, as the products may be made waterproof by the use of a larger percentage of resin, they may be used externally for decorative purposes as, for example, wall or roof cladding materials. Where the products of the invention are used for their primarily intended purpose, that is as floor coverings, they may be fitted in the manner of conventional carpets or they may be fitted in a manner similar to that used with tiles by adhesively attaching areas of the resin-impregnated pile fabrics to a solid base of, for example, wood or concrete. Alternatively, areas of the material may be adhesively attached to similar, usually square, areas of a thin rigid material such as hardboard or plywood to make laminated tiles which can be applied in the normal manner.

The invention is illustrated by the following examples in which percentages are by weight on the weight of the pile fabric.

EXAMPLE 1

A pile fabric was prepared by tufting a viscose rayon yarn through a hessian backing fabric, the tuft density being approximately 54 tufts per square inch.

The pile fabric was impregnated with 25 percent of an approximately 40 percent by weight emulsion of a self-crosslinking acrylic resin supplied by Styrene Copolymers Limited under the reference RP70–70. Thus the amount of resin itself applied was 10 percent on the weight of fabric.

Following drying of the impregnated fabric at 105° to 110° C., curing of the resin was accomplished by passing the fabric through an oven at a temperature of from 140° C. to 150° C. with a dwell time of about three minutes. The treated carpet stood up to wearing trials very much beter than a sample of the same carpet untreated with the resin.

EXAMPLE 2

A proprietary carpet having a pile composed of a mixture of viscose rayon and cellulose acetate fibres and a pile height of approximately 3/16 of an inch, was impregnated with a self-crosslinking acrylic emulsion, supplied by Styrene Copolymers Limited under the reference RP103/50/4, to the extent of depositing 5 percent of solids on the carpet. Following drying at 105° to 110° C. in an oven, curing of the resin was accomplished by placing the impregnated fabric between a pair of heated plates for three minutes, at a temperature of 150° C. The pile height was reduced in the curing step by approximately 40 percent. In wearing trials the treated carpet compared most favourably with the proprietary product which was not so treated.

EXAMPLE 3

A sample of the proprietary carpet described in Example 2 was impregnated with a self-crosslinking acrylic emulsion, supplied by Styrene Copolymers Limited under the reference number RP70–72, such that 94 percent of the resin was applied to the carpet.

The impregnated carpet was dried in an oven at 105° to 110° C. and thereafter curing of the resin was accomplished in a second oven at a temperature of 130° C. for half an hour. The pile tufts were bonded together in the resultant carpet which exhibited excellent durability whilst remaining resilient.

EXAMPLE 4

The resin employed in Example 3 was applied to a carpet having a pile containing equal amounts by weight of 15 denier 2½" staple length polyacrylonitrile fibres and 8 denier, 2½" staple length viscose rayon fibres; the carpet had a cut pile ¼ inch in height formed from high twist yarn. The amount of emulsion applied to the carpet was such that, after drying, 18 percent of resin was deposited thereon.

Drying of the carpet and curing of the resin were accomplished under the conditions described in Example 3. Adjacent pile tufts were bonded together in the carpet which was found to exhibit excellent durability.

EXAMPLE 5

The procedure of Example 4 was repeated with the exception that the impregnated carpet was dried slowly at a temperature of 45° C. in an oven having no air circulation. The product was found to have adjacent fibres within pile tufts bonded together although adjacent tufts were not bonded together. This resulted in the carpet having an appearance more like untreated carpets whilst still possessing enhanced durability.

EXAMPLE 6

A proprietary tufted carpet having a pile yarn comprising a mixture of viscose rayon and cellulose acetate and a pile height of approximately 3/16" was impregnated with a self-crosslinking acrylic resin emulsion, supplied by Styrene Copolymers Limited under the reference RP103/50/4, to the extent of depositing 50 percent of solids on the carpet. The resin emulsion contained, per 100 gms. of emulsion, 50 gms. of glass ballotini of average diameter about 0.75 mm.

The impregnated carpet was rolled to distribute the ballotini between the pile tufts and then, following drying of the impregnated carpet at 105° to 110° C. in an oven, curing of the resin was accomplished by heating the carpet in an oven for 3 minutes at about 150° C.

In wearing trials, the treated carpets compared favourably with untreated proprietary product. In addition the fire-resistance of the carpet was considerably increased.

EXAMPLE 7

A sample of a carpet having a loop pile of viscose rayon yarn and weighing 28 oz./sq. yd., was impregnated by spraying with Plyolite VP100, an aqueous emulsion of a terpolymer of butadiene, styrene and vinyl pyridine, to the extent of depositing 23.9 percent of the elastomeric resin on the carpet.

The impregnated carpet was dried in an oven at 40° C., it being unnecessary to use a higher temperature to obtain a nonsticky product. Adjacent pile fibres in the carpet were bonded together and the product compared very favourably, during durability trials, with an untreated sample of the same carpet.

EXAMPLE 8

The procedure of Example 7 was repeated with the exception that the impregnant employed was Marbond Latex 18360, an aqueous emulsion of a copolymer comprising 50 percent of styrene and 20.5 percent of resin was deposited on the carpet.

The impregnated carpet was dried at 90° C. to give a nonsticky product with excellent durability compared with an untreated sample of the same carpet.

What we claim is:

1. A floor covering comprising a carpet having a textile backing fabric and a plurality of carpet yarn elements extending normally to said backing fabric to form a pile, the adjacent individual filaments in each of said yarn elements in said carpet being bonded to one another by a cured self-crosslinking acrylic resin having a major portion of units derived from acrylic esters, said resin comprising between about 15% and about 100% by weight of the resin-free carpet.

2. A floor covering as claimed in claim 1 wherein the cured resin contains a particulate material.

3. A floor covering according to claim 2 in which the particulate material is glass beads.

4. A floor covering according to claim 3 in which the particulate material comprises from about 2 to about 10 percent by weight on the weight of pile fabric.

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