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TEXTILE SUBSTITUTE

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ABSTRACT OF THE DISCLOSURE

A textile substitute comprising a substrate of thin, flexible, permeable cellular polymeric material having a thickness in the range between about 10 mils and about 80 mils and a pore size in the range between about 10 pores per linear inch and about 150 pores per linear inch, laminated to a sheet of paper material having a thickness less than about 30 mils and a basis weight less than about 75 lbs. per ream.

This invention relates to novel laminates of certain permeable cellular polymeric materails with paper, which are useful as textile substitutes. The laminates of this invention include a layer of paper, of the "sanitary paper" type having a basis weight less than about 75 lbs. per ream, and having a thickness less than about 30 mils to a thin, flexible permeable cellular polymeric material having a pore density in the range from about 10 to about 150 pores per linear inch, and a thickness in the range from about 10 to about 80 mils.

In the past, textiles have been the materials of choice for such uses as garments, household furnishings, wiping materials and the like. The reason for their desirability has primarily been their wear properties, such as abrasion resistance, tear resistance, tensile strength, and also their appearance. Paper is a material which is exceedingly inexpensive to make, when compared with textiles or with nonwoven materials. On the other hand, paper has relatively low tensile strength, tear strength, and general wearability, and these properties are considerably decreased, below their already low values, when the papers are wetted. Although it has been suggested to increase the strength of paper by laminating the paper to other, higher strength materials, such as the reinforcing scrim of U.S. Pat. Nos. 2,954,816 and 2,954,817, these alternatives have been insufficient to make paper a truly practical substitute for textiles, because of their expensiveness of manufacture, and their inferior physical properties and appearance when compared with textiles. Also, when comparing these reinforced papers with textiles for garment purposes, a major cost of manufacturing garments, the fabrication costs per se, involving cutting, assembling and sewing, are comparable, whether garments are being fabricated from textiles or from reinforced paper.

Nonwovens have been suggested, and are utilized to a limited extent, as substitutes for textile materials. The nonwovens, which comprise mixtures of natural and/or synthetic fibers which have been adhesively bonded with a chemical adhesive, have represented a low-cost compromise between paper and textile for some applications. However, the nonwoven materials have been relatively expensive to fabricate in comparison with paper, are thicker than paper, having physical properties which are often inferior to textiles, and do not have the desirable softness and hand that is frequently desired in a textile substitute.

As used in this patent application, the term textile refers to synthetic and/or natural fibers which are mechanically interbonded to form sheets of material. Usually, individual textile filaments are formed into multifilament

strands or yarns, and these yarns are formed into sheets of material by such mechanical processes as weaving, knitting, and the like.

The nonwoven materials frequently utilize the same filamentary materials which are used for textiles, but in the nonwoven materials these filamentary substances are adhesively bonded by the application of chemical adhesives when the filaments are supported in an air stream, to form the final sheet. Textile and nonwoven products have significantly improved tensile strength, tear strength, abrasion resistance, and wet strength, when compared with conventional paper, and usually also when compared with prior art reinforced paper products. However, their cost of production is quite high, often ten or twenty times as great as the cost of manufacture of comparable sheets of paper. As used herein, paper means sheets of natural cellulosic fibers (which may include limited amounts of synthetic fibers) which cellulosic fibers are fastened to each other by the phenomenon of hydrogen bonding. Hydrogen bonding occurs when cellulose fibers are suspended in an aqueous medium, and the aqueous medium is then substantially removed. Although wood fibers, of the coniferous or deciduous type, are most frequently used in the manufacture of paper, other natural cellulosic fibers, such as jute, hemp, bagasse and the like are often frequently used, and are within the purview of this invention. The primary advantages of paper are the relatively low cost by which individual cellulosic fibers can be obtained by modern, mass production chemical, semi-chemical and mechanical pulping and bleaching techniques, and the extremely high speeds by which these fibers may be fabricated into sheets of paper on conventional paper machines. For example, in fabricating sanitary papers which are used for facial tissue, toilet tissue, napkins, and towels, on conventional Fourdrinier-type paper machines, sheets of paper of up to 15 foot widths are conventionally fabricated at machine speeds in the range from about 2000 to about 4500 linear feet per minute.

The instant invention overcomes the foregoing disadvantages of the prior art, and constitutes a laminate of a sanitary paper sheet and a thin sheet of flexible, permeable cellular polymeric material having a thickness in the range from about 10 mils to about 80 mils and having a pore density in the range from about 10 pores per inch to about 150 pores per inch. The product of this invention is relatively inexpensive to produce, because its components are inexpensive and because it may be readily fabricated, and has superior properties when compared with ordinary paper, and when compared with comparable prior art paper laminates. The product of this invention has improved wet tear and tensile strength, has good dry tear strength and dry tensile strength, and has good abrasion resistance. In addition, the product of this invention is soft, has a good drape, provides an appearance very much like fabric, and may be printed, cut, sewn, and otherwise fabricated in the same fashion as conventional textiles, as well as by the improved fabrication techniques discussed below.

The product of this invention has the additional advantage of being capable of being converted by high speed mass production techniques. By utilizing dielectrically sealable or relatively low melt temperature polymers, products of this invention may be fabricated into garments or home furnishings by such techniques as dielectrically sealing or heat-sealing when used for garment or household applications, the tendency of the instant invention to avoid wrinkling is a desirable feature.

Additionally, when utilized as a household wiper, the product of this invention has considerable resilience, and does not tend to ball up when immersed in water, but rather tends to open toward the laminar shape.

It is therefore an object of this invention to provide an effective, low-cost substitute for textile materials and nonwoven materials.

It is a further object of this invention to provide a textile substitute which may readily be fabricated into articles of clothing, and which possesses a drape, softness, hand and general appearance which is similar to that of conventional woven fabrics.

Another object of this invention is to provide a laminate comprising a layer of paper which has tensile and tear strength in the wet and dry state which are close to those of conventional textile materials, and which possesses other physical properties such as abrasion resistance which are comparable to textile materials.

Yet another object of this invention is to provide an inexpensive laminate which may be used to make clothing, and which resists wrinkling.

An additional object of this invention is to provide an inexpensive material which may be assembled by such mass production techniques as dielectric sealing or heat sealing, to mass produce garments, draperies, sheets, pillow cases, and other household, institutional, and industrial products requiring the joining of textile-like materials.

A concomitant object of this invention is to provide a textile substitute, which combines the basic physical properties and characteristics of the textiles and nonwoven material, but which is sufficiently inexpensive to render the same highly disposable.

The foregoing objects of this invention, and other objects of the invention, will be readily appreciated and understood with reference to the following detailed description of the invention.

The product of this invention comprises a sheet of paper laminated to a sheet of flexible, permeable cellular polymeric material. The papers which may be used in accordance with the invention are the so-called sanitary papers which are thin, flexible, soft and absorbent, and are conventionally used in the manufacture of household sanitary products such as facial tissue, toilet tissue, napkins and towels. These papers are conventionally made from a variety of hard wood and soft wood fibers, by techniques which are well established in the art. These papers are commonly described by their basis weight, and their thickness, and the paper sheeting used in accordance with this invention will have a basis weight of 75 lbs. per ream or less, and will preferably have a basis weight in the range from about 8 to about 25 lbs. per ream. The term ream, as used herein, is defined as 2880 square feet of paper. The papers of this invention will have a thickness of about 30 mils or less, and the thickness of the paper will preferably be in the range from about 3 mils to about 16 mils.

The papers which are most preferred to be used in the products of this invention will be the so-called "tissue" stock, which is the softer, finer sanitary paper. Tissue stocks for single-ply sheets have basis weights in the range from about 7 to about 14 pounds per ream, and thicknesses in the range from about 2.5 to about 6 mils per single ply sheet. Of these tissue stocks, the papers having basis weights in the range from about 8 to about 11 pounds per ream and a thickness of about 3 to about 5 mils are most preferred for those applications, such as female clothing, which require a softer, lighter outer layer.

The so-called "towel" stock will come in a range of basis weights in the range from about 15 to about 75 pounds per ream and thicknesses in the range from about 8 to about 30 mils. The preferred towel stocks, used in this invention, will have basis weights in the range from about 15 to about 50 pounds per ream and thicknesses in the range from about 8 to about 16 mils.

It may be desired, for certain purposes requiring greater absorbency, for example, to combine two or more sheets of paper for lamination to a sheet of flexible, permeable cellular polymeric foam, although the composite paper sheet in such an instance should not exceed about 30 mils in thickness.

In the manufacture of the sanitary papers, it is conventional to add certain resins to the furnish used in the paper-making process, which resins function to increase the wet strength of the papers. Such resins are frequently melamine formaldehyde or urea formaldehyde resins, and some usable urea formaldehyde resins are disclosed in U.S. Pat. No. 3,275,605. There are a variety of processing treatments, to which the paper may be subjected, on or off the paper-making machine, for varying the physical properties of the paper. For example, the paper may be creped from the drier, and the degree of crepe will affect the softness and absorbency thereof. Calendering, which is conventionally done on the paper machine may be varied to regulate the softness and strength of the paper. Also, the paper can be subjected to such after-the-paper-machine processing techniques as embossing, such as set forth in U.S. Pat. No. 2,834,809, for the purpose of giving the paper an embossed or quilted texture, and increasing the absorbency of the paper. Depending upon the application to which the product is to be put, it may be desired to decorate or print the paper, or to use a colored paper. Colored paper can readily be obtained by adding any one of a great variety of well-known dyes to the furnish, and colors and/or printed patterns may be placed upon the product by conventional printing techniques, so that the product may have any of the decorative pattern which may be imprinted upon conventional textiles. It may also be desired to coat the paper with substances, such as polymeric materials or the like, to improve the ink receptivity of the paper or other properties thereof. Papers subjected to any of the foregoing treatments or additions may be utilized in accordance with this invention.

The foam layer of the product comprises a thin, flexible, permeable sheet of cellular, polymeric material. The cellular, polymeric material, or plastic foams as they are sometimes known, may be produced by a variety of techniques. These production techniques involve the volatilization of a gas when the polymeric material is in a plastic condition. For example, if polyurethane foam is being produced, the foam formation is a concomitant of the polyurethane polymer-forming process. In the production of polyurethane foams a polyhydroxy-containing compound is reacted with a polyisocyanate, to form the polyurethane foam. If water is added to the reactant mixture, a reaction occurs between the water and the polyisocyanate, which results in the liberation of carbon dioxide, which conventionally functions as the blowing gas in polyurethane foam production. However, it is also possible to incorporate in the polyurethane-forming reactant mixture, low boiling point organic materials, such as pentane, which are volatilized by the exotherm of the polyurethane-forming reaction and which produce the cellular nature of the product. In other circumstances, as for example when a polyvinyl chloride foam is being produced the already-formed polyvinyl chloride polymer is blown by a blowing agent such as N_1N'-dinitrosopentamethylenetetramine, and the blowing agent is rapidly volatilized by the external application of heat, and the bubbles of the blowing agent provide for the cellular nature of the foam.

There are three types of polymeric foams. These are the closed-cell foams, the open-cell foams, and the reticulated foams. The type of foam which is obtained depends upon the particular polymer being produced, the conditions of the production of the polymer, and the after-treatment, if any, to which the polymer is subjected. When any polymeric foam is formed, the ultimate structure of the foam is a multiplicity of dodecahedral cells. Each dodecahedral cell has pentagonal cell walls. These cell walls are defined by five strands of the polymer comprising the foam, and a membrane of the polymeric ma-

terial may often stretch across the cell walls. When a polymeric foam has substantially all of its cell walls intact, that is to say when about 70% or more of the cell membranes are unbroken, the polymeric foam is considered to be closed-cell, and is essentially impervious to fluid flow therethrough at atmospheric pressure and ambient temperature. The so-called "open-cell" foams contain less than about 70% of intact cell membranes, but more than about 25% of intact cell membranes. These "open-cell" foams are permeable, and will permit the ready passage therethrough, at atmospheric pressure and ambient temperatures, of fluids. The so-called "reticulated foams" are foams wherein 25% or less of the cell walls are intact, and these products offer very low resistance to fluid flow therethrough at ambient temperature and atmospheric pressure. The open-cell or reticulated foams are both usable in the products of this invention, and therefore, for purposes of this patent application, the terms permeable cellular polymeric material and permeable foam are defined to encompass both open-cell foams and reticulated foams, as described above.

The flexible polyurethane foams are open-cell in nature, unless they are subjected to an after-treatment to reticulate them, such as in the manner set forth in U.S. Pat. No. 3,171,820. The polyvinyl chloride foams are also open-cell in nature. There is disclosed in copending patent application, Ser. No. 365,819 processes for producing reticulated polyolefin foams, and the reticulated and open-cell polyolefin foams may also be used in accordance with this invention. In that regard, it is to be noted, that polyolefin foams per se when originally produced, are closed-cell in nature.

The invention requires the use of a permeable, flexible polymeric foam. By flexible, for purposes of this invention, is meant a foam which, at a thickness of 80 mils when taking a sample 1 foot long and 2 inches wide, and supporting three inches of that sample at one end, between rigid horizontal members, will, within a period of five seocnds, bend under its own weight from the horizontal position to the vertical position.

The flexible polyurethane foams are the preferable foams for use in the product of this invention. Polyurethane foams are categorized as flexible, semirigid, and rigid, depending upon the resistance to compressive forces of the foam sample in question. The determination of which category a foam falls into, depends primarily upon the nature of the polyhydroxy-containing compound from which the foam is formed. There is no generally recognized, precise definition of a flexible polyurethane foam, but for general purposes, U.S. Pat. 3,025,200 describes the sorts of polyhydroxy-containing compounds which may be utilized in the manufacture of polyurethane foam. Too, the aforesaid patent discusses a variety of acceptable foam formulations, including polyisocyanates, catalysts, stabilizers and the like which are useful in the manufacture of flexible polyurethane foams.

In the manufacture of the polyurethane foams, polyhydroxy compounds are conveniently of the polyester type or of the polyether type. The polyether-type polyurethane foams are usually softer than the polyester-type foams, but have inferior physical properties, and are more difficult to peel in thin sections. Therefore, the particular type of polyurethane foam being utilized will depend upon the compromise which is desired to be made between softness and the physical properties such as the tensile strength, tear strength and ease of peeling of the foam. The permeable cellular polymeric foams of this invention will have a thickness in the range from about 5 mils to about 80 mils and a pore size in the range from about 10 pores per linear inch to about 150 pores per linear inch. If a product of this invention is desired to be used as a wiper, such as for wiping spills, washing dishes, washing windows, or the like, the thickness of the polymeric foam is preferably in the range from about 20 mils to about 35 mils. If the product of this invention is being used for heavy duty applications such as an industrial wiping towel, or the like, thicker foam elements such as in the range from about 20 mils to about 50 mils are to be preferred. For clothing purposes the thinner foams having a thickness in the range from about 10 mils to about 40 mils are preferable.

In the manufacture of the polymeric foams of the exceedingly thin thicknesses from about 10 to about 50 mils, of the sort described herein, are produced by peeling techniques which are well-known in the art. In some processes, for example in the process of U.S. Pat. No. 3,297,802, a cylindrical body of foam is produced. In other processes rectangular bodies of foam are produced. If a rectangular block of foam is to be peeled, to produce very thin sheets of foam, the corners of the block are cut off so that the foam piece is a solid cylinder, and a core is then drilled in the cylinder. The cylinder, in either event, is then mounted upon a rotating shaft, and a very sharp knife, mounted to advance toward the center of the foam member as the foam is peeled, is utilized for the purpose of peeling the very thin sheets of foam required for this invention. It is possible to peel thin sheets from a rectangular block, but this is extremely inefficient because it is wasteful of material and requires a shaping operation, and the variations in pore density are quite great in any section of a cylinder formed from a rectangular block.

The polymeric foams of this invention will have a pore size in the range from about 10 pores per linear inch to about 150 pores per linear inch. The particular pore size of the foam desired to be used in a product of this invention will depend upon the end use of the product in question. The relatively high pore density foams in the readily commercially available range from about 50 to about 100 pores per linear inch are quite soft, and are therefore preferred to be used in the clothing applications of the invention. However, if porosity is a desirable characteristic, such as where high breathability of the product is desired, the lower pore density foams, such as in the range from about 10 to about 30 pores per linear inch, are to be preferred. The open-cell foams are generally preferable, because they are less expensive to produce than the reticulated foams. However, if high permeability of the end product is an important characteristic, the open-cell foams of the polyurethane type may be reticulated by the caustic quench process set forth in U.S. Pat. No. 3,171,820 or by the explosion process set forth in U.S. Pat. No. 3,329,759, to remove most or all of the remaining cell walls and to obtain optimum permeability of any given pore density foam layer.

Generally, the foams having a pore density in the range from about 40 to about 100 pores per linear inch are most preferred for the laminates of this invention. In determining the particular relationship between the thickness of the foam and the pore size in any given product, there will be taken into account the porosity of the foam desired, the tensile strength of the foam sheet desired, and the desired hand or feel of the end product. For example, if an open-cell foam having a pore size of about 20 pores per linear inch is peeled to a thickness of about 20 mils, the end product will be highly permeable, because in such a large pore density, thin sheet, very few cell membranes will be presented, compared for example with the number of cell membranes in a sheet several times as thick. Also, it is important that the polyurethane or other foam, in its thin form, retain essentially its characteristic as a foam having a cellular structure and not be so thin and fragile as to appear like lace. For example, if a 10 pore per linear inch piece of foam is peeled to 5 mils the strands of polmer are so thin and so few strands are present in a given area of foam, that the foam has very little strength. In all cases, of course, the ultimate properties of any given foam layer in any given thickness and pore density, will depend upon the particular polymeric material being considered.

In fabricating the product of this invention, conventional simple fabricating techniques can be used. Paper is conventionally produced on a parent roll, and will preferably be fabricated into the laminate of this invention from its roll form. When the polymeric foam is peeled from a cylinder, it is also rolled onto a cylindrical roll. The foam layer may be laminated to the paper layer by the use of an adhesive or by a flame laminating process. If an adhesive is to be used, any number of a wide variety of adhesives, well-known in the art, may be applied. The important characteristics of any adhesive to be used for this invention are its ease and economy of application, its insolubility in water, and the strength of the adhesive bond produced. One such useful adhesive is Pliolite 610, a styrene-butadiene-rubber adhesive produced by the Goodyear Chemical Company. The adhesive may be applied to the foam or to the paper, and the individual components brought together between a pair of nip rolls to complete the lamination. Some adhesives are heat curable, and in these cases it is desirable to pass the formed laminate through a curing oven, set at a low temperature so that the paper and the foam themselves are unaffected, to complete the cure of the adhesive. In order to conserve adhesive, it is desirable to use an embossed cylindrical roll, which picks up adhesive only at the outer extremities of the individual embossments, so that the adhesive is applied in the spaced, predetermined pattern of the embossed adhesive-applying roll. The adhesive is preferably applied to an entire surface of the foam substrate, using an embossed roll to apply the adhesive. It is well known that polymeric foams such as polyurethane foam may be laminated to other materials by flame lamination, in the manner set forth in U.S. Pat. No. 2,957,793. This flame lamination process may be utilized for the purpose of laminating polyurethane foam to paper, in producing the products of this invention. In the event that a flame laminating process is utilized with respect to polyurethane foam, the polyurethane is passed over a conventional flame, by virtue of which part of the polymer at the face of the foam sheet closest to the flame is melted. This melted polymer functions as an adhesive when the melted face of the foam sheet is brought in contact with the paper such as by passing the two between a pair of nip rolls. Cooling of the melted polymer resets the polymer and therefore serves to cure the polyurethane adhesive. In conventional flame laminating processes for laminating polyurethane foam, approximately 15 to 20 mils of polyurethane foam are burned and/or melted off the foam sheet by the laminating flame. Consequently, in determining the thickness of the foam sheet to be laminated, the thickness of the foam lost in the flame laminating process must be taken into consideration. For example, if a laminate of foam and paper is desired to include a sheet of polyurethane foam having a thickness of 30 mils, and if flame lamination is the adhesion method chosen, the initial polyurethane foam sheet should have a thickness of about 45 or 50 mils, so that when 15 or 20 mils are burnt or melted off during flame lamination, the remaining sheet thickness is 30 mils of the cellular foam structure.

The polymeric foams, in thick section, have high coefficients of friction, and it would therefore be expected that garments produced from the laminates of this invention, with an inner polymeric layer, would "cling." However, from the standpoint of this invention, the cellular foam face of the end product conventionally will not interfere with the proper "hang" of garments produced pursuant to this invention. For example, if a laminate of this invention is to be used in fabricating a women's dress, the foam material would preferably be the inner material, and will move rather freely with the motion of the wearer, in a manner quite similar to that of conventional textile materials.

When considering the application of the instant product for clothing, it may be desirable to obtain increased insulation of the product. If this is the case, the polymeric foam sheet may be laminated between a pair of sheets of paper, and the high air content of the polymeric foam renders it a good insulator, and provides a garment which is useful in insulating the wearer against the cold. In such an application, the thicker foam thicknesses are to be preferred on the order of about 50 to 80 mils, because of the higher entrapped air volume which would be provided between the paper facing sheets.

In the event that it is desired to use the product of this invention as a wiper, it may be used with foam surface or paper surface down. If decreased drag on the foam surface is desired, the product of this invention may be coated with a so-called slip agent. Such a slip agent may be any low drag, low coefficient of friction compound, such as styrene butadiene latex, existing in the liquid state, when it is applied to the foam (and which later congeals) so that it may be applied to a face of the polymeric foam, such as by a gravure roll.

Depending upon the application to which the products of this invention are applied, it may be desirable, for aesthetic purposes, for the foam to be of a particular color or texture. Foams of various colors may be obtained by incorporating a suitable dye, the types of which are well known in the art, in the reactants when the foam is initially being formed. If it is desirable to provide the foam with a soft, smooth texture, or to increase the hydrophilicity of the foam to render the same useful for an application as a dishcloth, it may be desired to flock the foam. The foam may be flocked by immersing the same in adhesive, and by distributing over the surface of the foam a multiplicity of short fibers, such as cotton fibers or the like having a length of approximately 2 millimeters or less, the foam is given the appearance and texture of a suede. Of course, these flocks may also be dyed prior or subsequent to application, for appearance.

It is to be noted that it might be desirable to increase the strength of the product of this invention by inserting a thin reinforcing sheet between the paper and the polyurethane foam. For example, a thin polymeric scrim or mesh material may be laminated between the paper and the polyurethane foam for reinforcing purposes. Of course, in order to permit the breathability of the laminate, and to permit its use in dishcloth or towel applications, requiring absorbency, the reinforcing scrim must be highly permeable.

The most preferred products of this invention, from the standpoint of their use as dress materials, would utilize a single-ply tissue stock paper sheet having a basis weight in the range from about 8 to about 11 pounds per ream, and having a thickness in the range from about 3 to about 5 mils, flame laminated to a sheet of polyurethane foam of the polyether type, having a thickness in the range from about 10 to about 40 mils and a pore size in the range from about 40 to about 80 pores per linear inch. As noted above, in order to have an ultimate foam thickness of 15 mils in a flame laminated product, a 30 or 35 mil sheet of polymeric foam would be used as the starting material. Preferred polyether-type polyols for use in producing such foams are the propylene oxide adducts of glycerol.

When the product of this invention is to be used as a wiper, such as is useful for washing windows, automobiles, dishes, and the like, a towel stock paper, having a basis weight in the range from about 15 to about 50 pounds per ream and a thickness in the range from about 8 to about 16 mils, is preferably laminated to a sheet of polyester-type polyurethane foam having a thickness in the range from about 20 to 35 mils and a pore density in the range from about 50 to about 70 pores per linear inch. If a household wiper is being fabricated, it is most preferred to use a polyester-type polyurethane foam, produced from a polyester polyol such as esters of adipic acid and diethylene glycol.

When the product of this invention is considered for use in wiping applications, it may be desired to impregnate

the product with any one of a number of liquid or semisolid materials, so that the product may be used as an applicator. Some materials with which the polymeric foam layer of the invention may readily be impregnated are furniture polish, soap, glass cleaner, furniture wax and shoe polish. Of course, it will be appreciated, that any one of a wide variety of possible liquid or semisolid materials can be utilized to impregnate the polymeric foam layer of the invention to provide a higher useful applicator.

The products of this invention have a wide variety of possible uses, and have many advantages which are not provided by the materials of the prior art. For example, if the product of this invention is desired to be used as a textile substitute in the fabrication of clothing, it has the advantages that it is mildew resistant, that it is extremely inexpensive, that it may be readily disposed of, may be fabricated by high production techniques such as dielectric sealing, and may be provided with a variety of surface textures by inexpensive embossing patterns. In this regard the products of this invention may be used in the fabrication of handkerchiefs, bed sheets, pillow cases, tablecloths, disposable slippers, dresses, pants, shirts, ties, drapes, and the like. The products of this invention may be rewashed at least several times without substantially losing their desirable properties, and their relatively low cost of manufacture renders them exceedingly disposable, so that they may be disposed of after a single use, or perhaps after a few uses.

Because of the dielectric sealability of certain flexible, permeable cellular polymeric materials such as polyvinyl chloride, and the heat sealability of the meltable cellular materials, such as the polyurethanes, the laminates of this invention are capable of being fabricated into items requiring a bonded or joined seam by mass production techniques. By heat sealing or dielectric sealings of seams, the use of sewing machines can be obviated, and highly mechanized fabrication processes established for cutting and assembling articles from the laminates of this invention on high-speed sealing equipment. These low cost production techniques provide articles made of the product of this invention with the characteristic of being a low cost disposable item, while the physical properties of the product of this invention enable the same to be satisfactorily reused, even after laundering.

If the product of this invention is to be used as a textile substitute for its absorbent properties for wiping purposes, such as for dish cloths, its desirable characteristics in comparison with nonwoven products, paper per se, or textile materials are its high degree of strength, particularly in water, its very low cost, its disposability—while retaining its ability to be used a number of times—its absorbency, capacity, and softness. If this product is used as a household wiper, such as for washing dishes, in contrast to paper towels or nonwoven towels, which tend to ball up, the product of this invention will tend to open up to its laminar form when it is bunched up and the compressive forces are released. The products of this invention will not disintegrate or fall apart, as will many paper products after immersion for varying periods of time in water. From the standpoint of these absorbent applications, the product of this invention may be used as a towel, a washcloth, a bath mat, or a wiping cloth.

For economy of production, the products of this invention will preferably be manufactured in roll form and provided with transverse score lines to facilitate their separation into individual sheets. They may also be cut into individual flat or folded sheets for subsequent use.

When it is desired to use the high pore density foams, i.e., 60 or more pores per linear inch, in producing the products of this invention, the use of a conventionally formed sheet of paper may be avoided, and substantial manufacturing economies obtained, by utilizing a continuous sheet of the desired foam polymeric material in lieu of the Fourdrinier wire on a paper machine, and to deposit the paper fibers in the form of a pulp slurry on the foam polymer substrate. Vacuum boxes beneath the foam polymer substrate would facilitate the drainage of the water from the slurry and a paper sheet could be formed on the foam substrate, using fiber interlocking into the pores of the foam, to achieve a mechanical bond of the paper and the foam.

Having thus described our invention, it will be apparent that the invention contemplates and incorporates a substantial number of variables which may be modified and combined without departing from the spirit and scope of the invention. For example, the paper material utilized in the laminate of this invention may include some small amount of synthetic fibers to add to the properties of the individual paper fibers.

Having thus described our invention, we claim:

1. A textile substitute comprising a layer of paper having a basis weight less than about 75 pounds per ream and a thickness less than about 30 mils secured to a layer of flexible, permeable, cellular polymeric material having a thickness in the range from about 10 mils to about 80 mils and a pore size in the range from about 10 pores per linear inch to about 150 pores per linear inch.

2. A product as set forth in claim **1** wherein said polymeric foam is a polyurethane foam.

3. A product as set forth in claim **1** wherein said paper sheet has a basis weight in the range from about 8 to about 11 pounds per ream and a thickness in the range from about 3 to about 5 mils, and said polymeric foam sheet is a polyurethane foam having a thickness in the range from about 10 mils to about 40 mils and a pore density in the range from about 40 pores per linear inch to about 80 pores per linear inch.

4. A product as set forth in claim **1**, wherein said paper sheets has a basis weight in the range from about 15 to about 50 pounds per ream and a thickness in the range from about 8 to about 16 mils, and said polymeric foam is a polyurethane having a pore density in the range from about 50 to about 70 pores per linear inch and a thickness in the range from about 20 to about 35 mils.

5. A product as set forth in claim **1**, wherein said paper sheet is secured to said polymeric foam sheet by melted polymer of said polymeric foam sheet.

6. A product as set forth in claim **4**, wherein said polymeric foam sheet, at its outer surface, is coated with a slip agent.

7. A product as set forth in claim **1**, wherein said paper sheet is embossed.

8. A product as set forth in claim **1**, wherein said foam sheet is impregnated with a material selected from the group consisting of liquid and semisolid polishes, soaps and waxes.

9. An article of manufacture comprising two sheets, each such sheet comprising a layer of paper having a basis weight less than about 75 pounds per ream and a thickness less than about 30 mils secured to a layer of flexible, permeable, dielectrically heat sealable cellular polymeric material having a thickness in the range from about 10 mils to about 80 mils and a pore density in the range from about 10 pores per linear inch to about 150 pores per linear inch, said sheets having at least one contiguous dielectrically sealed interface.

10. An article of manufacture comprising two sheets of material each such sheet comprising a layer of paper having a basis weight less than about 75 pounds per ream and a thickness less than about 30 mils secured to a flexible, permeable sheet of heat sealable cellular polymeric material having a thickness in the range from about 10 to about 80 mils and a pore density in the range from about 10 to about 150 pores per linear inch, said two sheets having at least one contiguous interface at which said two sheets are heat sealed to each other.

11. A textile substitute comprising a sheet of thin, soft, towel-stock paper having a basis weight less than about 50 pounds per ream and a thickness less than about 16

mils, laminated to a sheet of flexible, permeable polyester-type polyurethane foam having a thickness less than about 40 miles and a pore density less than about 80 pores per linear inch.

12. A product as set forth in claim **11** wherein said sheets are secured to each other by an adhesive.

13. A product as set forth in claim **11** wherein said sheets are secured to each other by melted polyurethane foam from said polyurethane sheets.

14. A product as set forth in claim **11** wherein said towel stock is embossed.

15. A textile replacement comprising a sheet of soft tissue stock paper having a basis weight less than about 11 pounds per ream and a thickness less than about 5 mils secured to a sheet of open-cell, flexible polyether-type polyurethane foam having a thickness in the range less than about 40 mils and a pore density less than about 80 pores per linear inch.

16. A product as set forth in claim **9** wherein said polymeric material is a polyvinyl chloride.

17. A product as set forth in claim **9** wherein said polymeric material is a polyurethane.

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