

CUSHIONING MATERIAL, METHOD FOR MANUFACTURING CUSHIONING MATERIAL, LAMINATED BODY, METHOD FOR MANUFACTURING LAMINATED BODY, METHOD FOR USING CUSHIONING MATERIAL, CONNECTION STRUCTURE OF SHELTER PARTITION, METHOD FOR ASSEMBLING SHELTER PARTITION, METHOD FOR DISASSEMBLING AND STORING SHELTER PARTITION, AND METHOD FOR FORMING IMPACT-ABSORBING WALL PANEL FOR SHELTER

TECHNICAL FIELD OF THE INVENTION

[0001]

The present invention relates to a lightweight cushioning material made of polyolefin resin foam that can be used for mat material or partition material having excellent design, the cushioning material having linear patterns produced by exposing a fusion or adhesive layer to a wavy-shaped concave-convex structure face thereof. The present invention also relates to a laminated body using the cushioning material, methods for manufacturing the cushioning material and the laminated body, a method for using the cushioning material, a connection structure of shelter partitions that can be easily assembled by using the laminated bodies without using assembly tools or components, a method for assembling the shelter partition using the laminated bodies, a method for disassembling and storing the shelter partition, and a method for forming impact-absorbing wall panels for shelters.

BACKGROUND OF THE INVENTION

[0002]

Cushioning materials using resin foams have been conventionally used for packaging material, mats, and the like. For example, resin foams having mountain and valley parts, or concave-convex shapes, formed on the surface thereof have been used for such the cushioning materials.

[0003]

As an example of such the cushioning material, Patent Document 1 has disclosed a thermoplastic resin foam sheet having a concave-convex surface with a top skin. This has been widely used as material in various industries, such as impact-absorbing material, building material, heat insulating material, and sound absorbing material, or as material for various household articles, such as daily necessities or miscellaneous goods for sports and leisure, and as material for sports equipment.

[0004]

In a method for manufacturing the thermoplastic resin foam sheet of Patent Document 1, firstly, a band-shaped thermoplastic resin foam sheet having a uniform thickness is cut at the middle of its vertical direction into concave-convex shapes so as to be separated into two layers of upper and lower layers, or, alternatively, a band-shaped thermoplastic resin foam sheet having a uniform thickness is held being in concave-convex shapes and cut at the middle of its vertical direction so as to be separated into two layers of upper and lower layers. In this way, two foam sheets each having a concave-convex surface on one side are formed. Next, thermal energy is irradiated onto the concave-convex surface of the foam sheet so as to melt its surface, which is then cooled down. As above, the thermoplastic resin foam sheet having a concave-convex surface with top skin can be formed.

[0005]

Also, Patent Document 2 has proposed a soundproof floor structure in which a hard board is laminated onto a plastic foam body. This can be used suitably as floor material for various housing and warehouses, and is especially suitable for collective housing such as apartments.

[0006]

In general, when a relatively hard material is used as a finishing material for a floor base such as a concrete slab, noise produced by neighboring households may be propagated as solid sounds to downstairs and cause environmental deterioration. To provide soundproof means for such problems, various floor substrate materials, such as polyurethane foams, synthetic fiber non-woven cloths, and polyethylene foams, have been conventionally developed and used.

[0007]

Patent Document 2 discloses a soundproof floor structure in which a floor substrate material, which is formed of a foam body having valley parts and/or mountain parts on its surface, is laminated with a hard board. In Patent Document 2, the floor substrate material uses a plastic foam body laminated with the hard board, where the plastic foam body has a compressive hardness between 0.5 and 1.5 kg/cm², an apparent density between 0.05 and 0.12 g/cm³, and a hardness between 5 and 35. Thus, unlike the present application invention, the floor substrate material according to Patent Document 2 does not have any design features and, furthermore, uses materials other than the foam resin for the cushioning material or the resin body.

[0008]

Also, cushioning materials for mattresses and pillows etc. are widely used in fields like medical material etc., and Patent Document 3 has proposed a laminated foam body, which is excellent in dispersion of body pressure, and a method for manufacturing the same.

[0009]

The laminated body of Patent Document 3 includes a high-resilience foam body having a mountain-valley face and a low-resilience foam body that is closely joined to the mountain-valley face of the high-resilience foam body and is made of polyurethane foam having impact resilience of 10 % or less. The low-resilience foam body is integrated with the high-resilience body by insert molding to obtain sufficient performance. Patent Document 3 aims for dispersion of stress by using the low-resilience and high-resilience foam bodies that are put together via the mountain-valley face and supporting the stress applied to the upper low-resilience foam body by the mountain-valley face of the high-resilience foam body. The soundproof floor structure of Patent Document 3 is not aimed at improving design by using linear patterns on a designed surface.

[0010]

Also, Patent Document 4 has proposed an invention relating to a method for manufacturing a cushioning material, in which concave-convex structures of multiple wavy shapes are formed periodically in island shapes by profile processing and hard foam material are disposed on the concave portions.

[0011]

In Patent Document 4, a three-layered foam resin laminated body is prepared by adhering slightly hard soft foams or semi-hard foams on an upper and lower sides of a soft foam to stabilize the hardness of the convex portions of the concave-convex structures of wavy shapes obtained by profile processing, and then the three-layered laminated body is profile-processed as if striding across the upper and lower harder soft foams or semi-hard foams. However, the method of Patent Document 4 does not expose a fusion layer or an adhesive layer to the wavy-shaped concave-convex structure face to foam multiple ring-shaped linear patterns.

[0012]

Furthermore, Patent Document 5 describes a foam mat in which a concave-convex structure having continuous wavy shapes in a width direction on its surface is formed by profile processing and predetermined foam bodies are disposed on predetermined positions of the wavy-shaped concave-convex structure to improve its design.

Also, Patent Document 6 discloses an extendable cardboard bed that can be assembled from nearly twenty components without using any fixing tools such as tapes.

Patent Document 7 discloses a cardboard bed including a base formed by assembling ten or more cardboard pieces and a top plate.

[0013]

Patent Document 8 discloses an invention of a shelter partition that is formed by using cardboard partitioning boards. In this invention, the shelter partition can be assembled by using cardboard connection members at upper and lower straight parts and curved parts to join the adjacent partitioning boards.

Patent Document 9 discloses a partition structure for shelters in which partitioning units are joined to each other by using adhesive tapes. The partitioning unit is a cardboard plate-like material having crease lines at regular intervals along a length direction of the cardboard, and the material is folded repeatedly at the crease lines into a wavy shape so as to obtain self-standing ability.

[0014]

Patent Document 10 discloses a partitioning material that can be used in a disaster shelter. The partitioning material includes a foam resin having spindle-shaped closed cells with predetermined strength and has a plane material attached to its top face. The partitioning material can be bent at a predetermined angle.

[0015]

Patent Document 5 discloses an invention of a mat material having a continuous and periodic wavy-shaped concave-convex structure formed across a width direction of foam material on a surface thereof. At this time, by profile processing a laminated body or a multiple-layered resin foam having multiple layers of resin foams of different colors, two or three three-dimensional rows of band-shaped patterns are formed on the periodic concave-convex structure, or, instead of forming patterns, different types of foam agents are combined. However, the invention of Patent Document 5 does not expose a fusion layer or an adhesive layer to the wavy-shaped concave-convex structure face to form multiple ring-shaped linear patterns. Moreover, Patent Document 5 describes that the mat material of the invention can be used as a thin foam material such as an entrance mat, a bath mat, or a dining floor mat, and thus the mat material is inappropriate as partitions or the like in shelters because of lack of self-standing assembling abilities.

[0016]

Also, other than the cushioning materials and flooring materials mentioned above, beds and partitions made of cardboard are used for flooring materials and partitioning members as described in Patent Documents 6 to 9. However, since the flooring material made of cardboard requires many components to assemble, and cardboard has high moisture absorbency and no cushioning features, it is difficult to maintain comfortable environment for people living in evacuation shelters with cardboard-made materials. Although partitions and flooring mats using plastic sheets are also available, such resin sheets for partitions weigh around 10 kg, require joint parts, and are not easy to assemble. As described above, there have been no products so far that are light enough to be used for both flooring mats and partitions, are excellent in self-standing ability in assembling and moisture proof, and have sufficient cushioning features.

[0017]

The partitioning material of Patent Document 10 may be used as a floor material but cannot be used as a bed since it is thin and is not a profile-processed cushioning material or a laminated body having excellent design. Moreover, its foam body itself has no design features. It also requires adhesive agent or fixing means to be assembled, which is different from the present application invention where laminated bodies according to the present invention are only butted or fitted to each other to be assembled.

[0018]

A cushioning material or a laminated body using the cushioning material according to the present invention is light in weight and excellent in design since a fusion layer or an adhesive layer forms multiple ring-shaped linear patterns. At the same time, the cushioning material or the laminated body according to the present invention is excellent in cushioning, thermal insulation, and moisture-proof features so that a mat material that can eliminate defects of conventional floor materials made of cardboard can be provided. Furthermore, the cushioning material or the laminated body according to the present invention is excellent in self-standing ability in assembling, and thus can be used for partitions in shelters, which are easy to be assembled or stored.

RELATED ART

PATENT DOCUMENTS

[0019]

- [Patent Document 1] Japanese Unexamined Patent Application Publication No. 1995-80874 (JP-A-1995-80874)
- [Patent Document 2] Japanese Unexamined Patent Application Publication No. 2000-054610 (JP-A-2000-054610)
- [Patent Document 3] Japanese Unexamined Patent Application Publication No. 2005-059358 (JP-A-2005-059358)
- [Patent Document 4] Japanese Unexamined Patent Application Publication No. 1980-120813 (JP-A-1980-120813)
- [Patent Document 5] Japanese Examined Utility Model Application Publication No. 1969-013645 (JP-UM-B-1969-013645)
- [Patent Document 6] Japanese Unexamined Patent Application Publication No. 2019-122644 (JP-A-2019-122644)
- [Patent Document 7] Japanese Registered Utility Model No. 3226650
- [Patent Document 8] Japanese Unexamined Patent Application Publication No. 2003-129593 (JP-A-2003-129593)
- [Patent Document 9] Japanese Unexamined Patent Application Publication No. 2006-274740 (JP-A-2006-274740)
- [Patent Document 10] Japanese Unexamined Patent Application Publication No. 2017-061827 (JP-A-2017-061827)

SUMMARY OF THE INVENTION

(PROBLEMS TO BE SOLVED BY THE INVENTION)

[0020]

Although Patent Documents 1 to 3 relate to resin foams having periodic wavy-shaped concave-convex structures on their surfaces, all of them are used merely for their cushioning features without any quality requirements for their appearances. Thus, the resin foams have not been used with design features. For example, design features are unnecessary for cushioning materials for packaging, and cushioning materials for beddings etc. are used being unexposed and it has not been considered to give design features such as patterns to such materials.

[0021]

Also, Patent Document 4 discloses an invention of disposing foam materials of different hardness at predetermined positions of the wavy-shaped concave-convex structure face formed by profile processing, and Patent Document 5 discloses an invention in which a concave-convex structure having continuous wavy shapes in a width direction on its surface is formed by profile processing and predetermined

foam bodies are disposed on predetermined positions of the wavy-shaped concave-convex structure to improve its design. However, none of these inventions profile-process a laminated foam body interposing a colored fusion layer or an adhesive layer to form multiple ring-shaped linear patterns on the wavy-shaped concave-convex structure face to improve their design features, and, moreover, the fusion layer or the adhesive layer has no functionality. The inventions of Patent Documents 6 to 9 do not use resin foams, do not excel in design, require a lot of assembling components, and have high moisture-absorbency and no cushioning features. Thus, it is impossible to maintain comfortable environment for the people living in the shelters with these materials. The foam body according to Patent Document 10 is not itself excellent in design features, is not profile-processed, and cannot be used as a bed.

[0022]

The present invention was made in view of such problems. Its object is to provide a cushioning material, a laminated body, methods for manufacturing the cushioning material and the laminated body, a method for using the cushioning material, a connection structure of shelter partitions using the laminated bodies, a method for assembling the shelter partition using the laminated bodies, a method for disassembling and storing the shelter partition, and a method for forming impact-absorbing wall panels for the shelter. To improve an appearance of the cushioning material, a fusion layer or an adhesive layer is exposed to a surface of a wavy-shaped concave-convex structure of the cushioning material so as to form multiple ring-shaped linear patterns to improve design of the cushioning material. The cushioning material is light in weight and excellent in design. At the same time, the cushioning material is formed of polyolefin resin foam so as to have excellent moisture-proof features, and the adhesive layer or the fusion layer can have functionality such as vibration control and soundproof features.

(MEANS FOR SOLVING PROBLEMS)

[0023]

To achieve the above objects, a first invention is a cushioning material including a polyolefin resin foam forming mountain parts, a polyolefin resin foam forming valley parts, the polyolefin resin foam forming the mountain parts being laminated on the polyolefin resin foam forming the valley parts, and an adhesive layer or a fusion layer formed between lamination planes of the polyolefin resin foams. The cushioning material has a profile-processed first face and a flat second face, and the

first face has a wavy-shaped concave-convex structure in which the mountain parts and the valley parts are alternately and periodically disposed in horizontal and vertical directions. The adhesive layer or the fusion layer formed substantially parallel to the second face is exposed to a part that is at a predetermined height of the wavy-shaped concave-convex structure of a front face, forming multiple ring-shaped linear patterns that are predetermined intervals apart from each other. The linear pattern separates the mountain part and the valley part of the wavy-shaped concave-convex structure and is formed in a ring shape at the predetermined height between the mountain part and the valley part so as to surround each mountain part. In particular, the cushioning material is used not only as partitioning walls in shelters but also can be suitably used as mats for disaster use, which can also be used as beds, since the cushioning material is formed of profile-processed foam material with excellent design and thermal insulation and moisture-proof functions.

[0024]

In this way, multiple two-dimensional, ring-shaped, and colored linear patterns that are predetermined intervals apart from each other can be formed on the front face of the cushioning material at the predetermined height. A position where the linear patterns are formed at the predetermined height can be adjusted accordingly between the mountain parts and the valley parts.

[0025]

Either the fusion layer or the adhesive layer forms the linear patterns. When the fusion layer forms the linear patterns, the resin foam to be fusion bonded in which at least one of fusion planes is colored with a different color may be used to form the linear patterns. When the adhesive layer forms the linear patterns, the adhesive layer formed by using a colored adhesive agent may be used. The linear patterns can be colored with any colors by painting the fusion plane or using the colored adhesive agent for the adhesive layer.

[0026]

The fusion layer or the adhesive layer may be a fusion layer, and the fusion layer may be colored selectively, at the time of crystallization of a surface of a resin foam forming the fusion layer during a process of solidifying following melting, with a different color by superimposing crystallization state, the change in molecular orientation, and effects of residuals of ADCA (azodicarbonamide) remaining on the surface of the resin foam. Specifically, a surface of the uncolored white resin foam can be selectively turned yellow during a re-crystallization process by fusion

bonding using, in addition to crystallization state and the change in molecular orientation, effects of residuals of ADCA remaining on the surface. Here, since foamed gas is likely to go off near the surface of the foam body, consumption of ADCA, which is a foaming agent, can be suppressed on the surface of the foam body compared to the consumption of ADCA within an inner side of the foam body.

[0027]

At this time, when coloring by crystallization at the time of melting and solidifying of the fusion layer, the uncolored white resin foam is melted, for example, so that the surface of the resin foam and a fusion bonding part are melted and crystallized once again at the time of fusion bonding, and by superimposing this crystallization state, the change in molecule weight, effects of residuals of ADCA that are likely to remain on the surface, etc., the fusion bonding part can be colored into yellow. Change in color of the fusion layer at the time of fusion bonding may be utilized in this way. Alternatively, the resin foam whose surface is painted with a predetermined color may be adhered. Also, when foaming the cushioning material using adhesion, the similar linear patterns can be formed by adding pigment of a predetermined color, such as yellow or red pigment, to the adhesive agent.

[0028]

The first face of the cushioning material is divided into three sections: the mountain parts formed of the resin foam on an upper side of the linear patterns, a linear pattern formation part where the linear patterns are formed, and the valley parts formed of the resin foam on a lower side of the linear patterns, wherein the adjacent valley parts are joined to each other to be integrated, and three-dimensional patterns may be formed by coloring either the mountain parts or the valley parts with a color different from the linear pattern formation part.

[0029]

At this time, to form the mountain parts, the valley parts, and the linear patterns in all different colors, either the mountain parts or the valley parts and the adhesive agent may be colored with pigment to form the surface, or a bonded plane of the foam body forming the fusion layer may be colored by painting or the like before fusion bonding.

[0030]

In addition to two-dimensional patterns of the linear pattern formation part, by coloring both the mountain parts and the valley parts of the wavy-shaped concave-convex structure with different colors, three-dimensional patterns in which

the linear pattern formation part, the mountain parts, and the valley parts are all colored with different colors may be formed.

[0031]

The linear pattern can be formed at any height within a range of a height of the wavy-shaped concave-convex structure, and forming the linear pattern on a side of the mountain parts above the center of the height of the wavy-shaped concave-convex structure may be able to form the smaller linear patterns or colored patterns in the mountain parts, or forming the linear pattern on a side of the valley part below the center of the height of the wavy-shaped concave-convex structure may be able to form the larger linear patterns or colored patterns in the mountain parts. The wavy-shaped concave-convex structure can be formed by profile processing, and adjusting forming height of the wavy-shaped concave-convex structure can alter the size of the ring-shaped patterns of the linear patterns.

[0032]

Raw material for the resin foam may be at least any one selected from a group consisting of polyethylene, low-density polyethylene, high-density polyethylene, ethylene-vinyl acetate copolymer, and polypropylene resin, or a mixture of two or more of the above. Furthermore, the resin foam may include a predetermined amount of polyethylene resin or polypropylene resin including carboxyl group, such as maleic anhydride, or functional group having an acid anhydride structure. Here, the predetermined amount of polyethylene resin or polypropylene resin including carboxyl group, such as maleic anhydride, or functional group having an acid anhydride structure compounded in the resin foam is preferably between 0.5 and 10 pts.mass, or more preferably between 0.5 and 5 pts.mass when total of the raw material is 100 pts.mass.

[0033]

The resin foam may be a polyethylene resin foam, and the polyethylene resin foam may have a closed-cell structure whose foaming ratio is between 20 and 40 times, and, furthermore, a permanent compression set according to JIS K6767 of the polyethylene resin foam is between 3.0 % and 7.4%, and a compression stress thereof at a test temperature of 25 °C at the time of 25 % compression is between 34 kPa and 56 kPa.

[0034]

The wavy-shaped concave-convex structure may include the adhesive layer of the cushioning material added with functionality.

[0035]

The adhesive layer formed of an adhesive agent may be formed between the lamination planes of the resin foams. The adhesive layer may be given with a vibration control function by using the adhesive agent including at least one of flexible resin selected from a group consisting of urethane resin, vinyl acetate emulsion, acrylic resin, silicone resin, and modified silicone resin as a main component, or may be given with flame-retardant and vibration control functions by using the adhesive agent including acrylate ester copolymer, halogenated phosphate ester, and inorganic flame retardant as essential components.

[0036]

The resin foam may include a predetermined amount of any of dispersed silica, zirconium phosphate, zeolite, zinc sulfate, or zirconium sulfate as a deodorant. Also, the resin foam may include a predetermined amount of any of dispersed amorphous calcium phosphate particles adsorbing or carrying silver ions, anatase-type titanium oxide crystal particles having photocatalytic effect, metallic compound particles of silver, copper or zinc, or metal fine particles of silver, copper, or zinc as an antibacterial agent or an antiviral agent. The amount of content of such the deodorant or antibacterial agent is preferably in a range between 0.5 and 10 pts.mass, or more preferably between 0.5 and 5 pts.mass, within 100 pts.mass of the resin component.

[0037]

The cushioning material may be used as a mat material for disaster use with the face formed with the wavy-shaped concave-convex structure as an upper surface and the other face as a lower surface. The cushioning material can be used as a bed since the cushioning material is formed of a profile-processed foam material. Thus, shelter partitions can be used effectively without providing exclusive space for beds.

[0038]

According to the first invention, the adhesive layer or the fusion layer is exposed to a part that is at a predetermined height of the wavy-shaped concave-convex structure on the front face, forming the multiple ring-shaped linear patterns that are predetermined intervals apart from each other, and thus providing high design quality. Thus, the cushioning material that is suitable for exposed usage can be obtained. The cushioning material according to the first invention is preferably cut in a straight line connecting positions of inflection points of the profile-processed surface thereof so as to make an area of a substantially parallel cut section of an end face of the cushioning material as large as possible.

[0039]

Also, the fusion layer or the adhesive layer being exposed on the front face of the wavy-shaped concave-convex structure forms the linear pattern, which separates the mountain part and the valley part of the wavy-shaped concave-convex structure and is formed in a ring shape at the predetermined height so as to surround each mountain part, and thus the design quality can be improved. Also, the linear patterns can be colored with any color by fusion bonding the resin foam whose top face, which is a fusion bonding plane, is painted, or using the resin foam having the adhesive layer colored with pigment or paint. For example, as a basic structure of the linear patterns of the present invention, if the fusion or adhesive layer is colored, the foams that are joined to each other interposing the fusion or the adhesive layer may be non-colored i.e. white colored. In this case, if the fusion or adhesive layer is colored with blue or yellow, the cushioning material in which the blue or yellow colored multiple linear patterns are formed at the predetermined position of the mountain parts of the wavy-shaped concave-convex structure and the remaining parts are white colored can be obtained.

[0040]

Here, if the fusion layer forms the linear patterns, the fusion layer is selectively colored by, at the time of fusion bonding, superimposing crystallization state during the process of solidifying following melting of the uncolored, the change in molecular orientation, and effects of residuals of ADCA remaining on the surface of the resin foam. Thus, it is unnecessary to apply pigment or painting to the surface of the foam to be fusion bonded.

[0041]

Also, the first face of the cushioning material is divided into three sections: the mountain parts, the linear pattern formation part, and the valley parts. If at least one or two of the mountain parts and the valley parts are colored with different color(s) from the linear pattern formation part, it is possible to form the three-dimensional linear patterns in addition to multiple ring-shaped patterns formed on the same two-dimensional plane, and thus higher design quality can be obtained.

[0042]

Also, changing the height at which the linear patterns of the cushioning material are formed can change the size of the linear patterns and the size of surface area of the colored parts of the mountain parts or the valley parts. This can give variation to the design.

[0043]

Also, the resin foam made of polyethylene is suitable for exposed usage since polyethylene does not easily absorb moisture. On the other hand, the resin foam made of urethane resin, which has hydrolyzability and is usually an open-cell resin foam, is unsuitable for exposed usage. Although various types of polyolefin resin can be used for the resin foam, in particular, if closed-cell foamed polyethylene is used, the cushioning material does not absorb moisture and thus can provide comfortable sleeping or living environment. Also, if the resin foam includes the predetermined amount of polyethylene or polypropylene resin including carboxyl group, such as maleic anhydride, or functional group having an acid anhydride structure, this can improve fusion bonding at the fusion bonding plane and is more preferable.

[0044]

Also, if the resin foam is a polyethylene resin foam with a closed-cell structure having a permanent compression set according to JIS K6767 between 3.0 % and 7.4%, and a compression stress at a test temperature of 25 °C at the time of 25 % compression between 34 kPa and 56 kPa, appropriate cushioning and moisture proof functions can be obtained.

[0045]

Also, if the adhesive layer of the cushioning material is given with functionality, the cushioning material can have both the design and functionality such as vibration control, fire resistant, and cushioning features. A higher total occupancy rate of the adhesive layer disposed on a substantially same plane to a total area of the cushioning material in planar view is preferable for enhancing such functions.

[0046]

In particular, using the adhesive agent including particular flexible resin as a main component or using the adhesive agent including acrylate resin or halogenated phosphate ester including inorganic flame retardant can give vibration control and flame-retardant functions to the adhesive layer. As above, giving such effects to the adhesive layer is effective.

[0047]

Also, by including a predetermined amount of silica, zirconium phosphate, zeolite, zinc sulfate, or zirconium sulfate as a deodorant in the resin foam used in the cushioning material or the laminated body, or by including a predetermined amount of any of amorphous calcium phosphate particles adsorbing or carrying silver ions, anatase-type titanium oxide crystal particles having photocatalytic effect, metallic compound particles of silver, copper or zinc, or metal fine particles of

silver, copper, or zinc as an antibacterial agent or an antiviral agent, the cushioning material can have deodorant, antibacterial, or antiviral effects.

[0048]

Also, as organically derived material or salts that excel in antiviral performance, there are alkyl benzene sulfonic acid based compounds, sodium salts, alkali metal salts such as potassium salts, alkali earth metal salts such as calcium and valium, and sulfonic acid based surfactant. Thus, a method in which applying aqueous emulsion etc. of such compounds onto the surface of the cushioning material is also considered as effective. Alkyl benzene sulfonic acid based compounds that excels in antiviral performance are more preferable.

[0049]

A second invention is a laminated body including the cushioning material according to the first invention and a sheet-shaped resin foam, wherein the separate sheet-shaped resin foam made of polyolefin resin is further laminated by adhering or fusion bonding onto the flat rear face of the cushioning material, which is the other face of the surface formed with the wavy-shaped concave-convex structure. For example, an average thickness of the laminated body is between 20 mm and 50 mm, and more preferably between 20 mm and 40 mm. This is because, if the average thickness of the laminated body is less than 20 mm, thermal insulation and moisture proof are insufficient and the laminated body is not suitable to be used as a bed. Also, if the average thickness is more than 40 mm, the laminated body becomes heavy, making it hard to be assembled and causing an increase in cost at the same time. Here, for example, the laminated body having a foaming ratio of 30 times and a dimension of 1800 mm length by 880 mm height by 30 mm mountain part thickness (the average thickness: 25 mm) weighs 1.25 kg, and, if the average thickness is 50 mm, the laminated body weighs 2.5 kg.

[0050]

The separate sheet-shaped resin foam used in the laminated body may have a harder strength than or equivalent strength to that of the resin foam with the wavy-shaped concave-convex structure. "Harder strength" means a smaller amount of deformation of a material against the same compression load, and "equivalent strength" means the same amount of deformation of the material against the same compression load.

[0051]

For example, for resin foams made of the same components, setting its foaming ratio lower can make the resin foam to have harder strength. In the

descriptions hereinafter, the “resin foam” represents the resin foam that is used for both the cushioning material, which has the wavy-shaped concave-convex structure formed with the linear patterns, and the laminated body, in which the separate sheet-shaped resin foam is adhered or fusion bonded onto the flat face of the cushioning material.

[0052]

The laminated body can be used as mat material for disaster use that can be used as partition sidewalls or beds in disaster shelters at the time of disaster, and can also be used as impact-absorbing wall panel material during the normal time. Here, the partitions can be used to partition sections for each evacuated family.

[0053]

The laminated body includes the resin foam having the foaming ratio of 40 times or more, and the laminated body may excel in self-standing ability in assembling if the laminated body satisfies 50 % or more of a height ratio R , wherein R is a ratio of a height (H_v) to a height (H_c), wherein H_v is a height from the flat face of the sheet-shaped resin foam on the rear face of the laminated body to the valley part, and H_c is a height from the flat face of the sheet-shaped resin foam on the rear face of the laminated body to a centerline of the wavy-shaped concave-convex structure.

[0054]

Here, H_c is an average height of a height (H_m) and H_v , wherein H_m is a height from the flat rear face of the sheet-shaped resin foam of the laminated body to the mountain part, and H_v is a height from the rear flat face of the sheet-shaped resin foam of the laminated body to the valley part. That is, H_c is a ratio of an average height of the profile-processed face to the height of the valley part of the profile-processed face from the rear face of the laminated body, which corresponds to a ratio of the average height of the profile-processed face (the centerline height) to the height of the non-profile-processed face.

[0055]

In the present invention, “self-standing ability in assembling” means that there is no slant or warp occurring at free ends while fixing the laminated bodies to each other. In more details, when fixing the generally rectangular laminated bodies each having a longer side of a predetermined length that is twice a length of a shorter side, two fixing ends, which are a side end part of the shorter side and a side face of the shorter side of the rear faces of the laminated bodies, are butted at substantially right angles to each other and fixed by using simple fixing means to be

assembled. The free ends are end faces of the shorter sides of the laminated bodies on the opposite side of the fixing ends. The self-standing ability in assembling allows easy and stable assembling of the partitions. Here, as the simple fixing means, loop-and-hook fasteners may be used, or other fixing members such as a tape-like member fixed with button-type fasteners (snap fasteners) or magnets may also be used. Hereinafter, the simple fixing means will be simplified as the “fixing means”.

[0056]

The loop-and-hook fastener may be fixed to the laminated body by fixing a rear face of the loop-and-hook fastener by using a bonding agent or adhesive agent. The tape-like member to which button-type fasteners or magnets are attached may be fixed to the laminated body by using the bonding agent or adhesive agent. The fixing means are preferably provided uniformly over the entire shorter side from the top end part to the bottom end part thereof. However, the fixing means may be separated at upper, middle, and lower parts if the laminated body can be supported stably enough.

[0057]

Also, a thickness of the resin foam can be increased by laminating further the separate sheet-shaped resin foam onto the other face of the resin foam of the cushioning material, forming the laminated body. This can also improve the cushioning feature as well as the moisture proof performance of the cushioning material. Furthermore, the self-standing ability in assembling when used as partitions can also be enhanced.

[0058]

At this time, this separate sheet-type resin foam has strength that is harder than or equivalent to that of the resin foam having the wavy-shaped concave-convex structure, and this can prevent excess sinking of the cushioning material while maintaining the cushioning features.

[0059]

As above, by making the cushioning material into the laminated body, the laminated body can be used as the mat material for disaster use that can be used as partition sidewalls or beds in shelters at the time of disaster and as the impact-absorbing wall panel material during the normal time. Thus, the same cushioning material can be used in various ways, which is highly convenient.

[0060]

The laminated body uses the resin foam having the foaming ratio between 20 times and 40 times, and the ratio R in percentage of the height from the flat rear face of the sheet-shaped resin foam of the laminated body to the centerline of the wavy-shaped concave-convex structure face (Hc) to the height from the rear flat face the sheet-shaped resin foam of the laminated body to the valley part (Hv) of the laminated body is 50 % or more. This allows the center of gravity of the laminated body to be located within the flat face part, which enables easy assembling without having any slight warps or curves between the joints. Thus, the laminated body can be assembled easily to assemble the shelter partitions. It is preferable that the laminated body according to the second invention is cut in a straight line connecting positions of inflection points of the profile-processed surface of the laminated body so as to make a substantially parallel area that occupies a cut section of an end face of the laminated body as large as possible.

[0061]

As above, the laminated body of the second invention can provide the mat material for disaster use, which can be used as partitions, beds, or impact-absorbing wall panel, having excellent design and self-standing ability in assembling.

[0062]

Such the cushioning material or the laminated body can be used as the mat material for disaster use, which can be used as beds. The cushioning material can also be used as partition material or impact-absorbing wall panel material. Also, when used in shelters, the cushioning material or the laminated body given with deodorant, antibacterial, or antiviral effects can be used as any of the mat material for shelters, partition material, and impact-absorbing wall panel material, and this can improve hygienic conditions in the shelters.

[0063]

A third invention is a method for manufacturing the cushioning material. The method includes cutting by slice-processing the sheet-shaped resin foams having predetermined thicknesses, facing each other, and interposing the colored adhesive or fusion layer immediately after passing through profile rolls at a position including the adhesive or fusion layer in a horizontal direction, which is perpendicular to a thickness direction of the resin foams, before pressing force applied by upper and lower rolls is not completely elastically restored, so that the resin foams are cut as if being cut across the curved adhesive or fusion layer while the adhesive or fusion layer is in a curved state, which is then followed by elastic restoration of the cut and separated resin foams, and forming the adhesive or fusion

layer into a predetermined length and shape as a flat face so that multiple periodic ring-shaped two-dimensional linear patterns are formed on a same plane as an exposed part on the flat face at a part at a predetermined height between the mountain part and the valley part of the wavy-shaped concave-convex structure face of the resin foams. In this case, the sheet-shaped resin foams interposing the adhesive or fusion layer may be non-colored white resin foams.

[0064]

Coloring at least one of the sheet-shaped resin foams having predetermined thicknesses facing each other interposing the colored adhesive or fusion layer, or coloring both the resin foams with different colors, may form three-dimensional patterns, in addition to two-dimensional multiple ring-shaped patterns formed on the same plane, in which the mountain part side is colored differently from the valley part side of the wavy-shaped concave-convex structure with the adhesive or fusion layer as a boundary surface.

[0065]

Within a width range of curves of the adhesive or fusion layer of the resin foams formed by the rolls, by shifting a forming position of the adhesive or fusion layer of the resin foam or by changing a height at which the slicing process is performed at an exit side of the rolls, forming positions of the mountain parts and the valley parts of the wavy-shaped concave-convex structure may be adjusted and thus size of the linear patterns may be adjusted so that a pair of the cushioning materials having the linear patterns of different sizes may be obtained. Thus, by slicing at a position that is offset from the position corresponding to a center height between the upper and lower rolls, the cushioning materials having linear patterns of different sizes can be obtained. Also, as for the laminated bodies described below, a pair of the laminated bodies having the linear patterns of different sizes can be obtained by similarly offsetting the slicing position.

[0066]

According to the third invention, the cushioning material having excellent design with the multiple linear patterns can be easily manufactured. Also, using the different colored resin foam as the sheet-shaped resin foam can change the linear patterns into three-dimensional patterns.

[0067]

Also, within a width range of curves of the adhesive or fusion layer of the resin foams formed by the rolls, by shifting a forming position of the adhesive or fusion layer of the resin foam or by changing a height at which the slicing process is

performed at an exit side of the rolls, the size of the linear patterns or the three-dimensional patterns formed on the resin foams can be adjusted. Also, attaching the sheet-shaped resin foam to the flat rear face of the cushioning material can improve not only its design but also the self-standing ability in assembling of the laminated body. Furthermore, the basic functionality as a foam material, such as thermal insulation, impact absorption, or moisture proof, can be improved.

[0068]

As above, by performing slice-processing, the linear patterns or the patterns formed on the mountain part side by the resin foam can be formed smaller, or, in contrast, the linear patterns or the patterns formed on the mountain part side by the resin foam can be formed larger, for example. This makes it possible to highlight the mountain part side more, or to highlight the valley part side more.

[0069]

Also, a fourth invention is a method for manufacturing a laminated body. The method includes using a four-layered laminated resin foam including two sheet-shaped resin foams, which have predetermined thicknesses, face each other, and interpose a colored adhesive layer or a fusion layer, and separate sheet-shaped resin foam layers each of which is adhered or fusion bonded onto each of outer sides, which are opposite sides of the adhesive layer or the fusion layer, of the sheet-shaped resin foams; slice-processing the four-layered resin foam in a horizontal direction, which is perpendicular to a thickness direction of the resin foam, while maintaining the curved shape formed by the profile roll processing so as to cut across the adhesive layer between the two inner resin foam layers of the four layers; and forming the mountain parts and the valley parts only on the two inner resin layers and integrating the resin foams of the inner resin layer and the outer resin layer.

[0070]

Also, the laminated body can be obtained by slice-processing the four-layered sheet-shaped resin foam under predetermined conditions at the time of profile processing. In this way, the laminated body of the present application can be obtained without attaching the sheet-shaped foam to the rear face of the cushioning material.

[0071]

According to the fourth invention, the laminated body including the cushioning material with excellent design and the sheet-shaped resin foam that is

fusion bonded or adhered to the flat face of the cushioning material can be easily manufactured.

[0072]

A fifth invention is a method for using the cushioning material, in which the flat faces of the cushioning material according to the first invention face each other. The cushioning materials are put on top of the other with their wavy-shaped concave-convex structure faces facing an outer surface and their flat faces facing each other. A supporting member support the cushioning materials so that the cushioning materials can be used standing with the multiple linear patterns formed side by side on the outer surface, and thus the cushioning materials can be used as a partition having design and impact-absorbing features.

[0073]

More particularly, since the faces with the wavy-shaped concave-convex structures of the pair of cushioning materials face outward in the opposite directions to each other and the flat rear faces of the wavy-shaped concave-convex structures are in contact with each other, the mountain parts formed on the first cushioning material and the valley parts formed on the second cushioning material are disposed a predetermined distance apart and, at the same time, the valley parts formed on the first cushioning material and the mountain parts formed on the second cushioning material are disposed a predetermined distance apart. Thus, the method for using the cushioning material in which the faces of the pair of the cushioning materials have the wavy shapes that are substantially parallel to each other can be obtained. Facing the wavy-shaped concave-convex structures outward can make both faces of the laminated body excellent in design, and thus the laminated body can be suitably used as partitions.

[0074]

The fifth invention may also be the method for using the cushioning materials, in which a pair of the cushioning materials according to the first invention are put on top of the other, laminating the cushioning materials having functionality. The wavy-shaped concave-convex structure faces of the cushioning materials are put on top of the other so that the linear patterns are formed side by side on a substantially same plane. A total occupancy rate of the adhesive layer to an entire plane is preferably 80 % or more.

[0075]

More particularly, the faces with the wavy-shaped concave-convex structures of the pair of the cushioning materials face each other so that the mountain parts

formed on the first cushioning material and the valley parts formed on the second cushioning material are disposed facing each other and, at the same time, the valley parts formed on the first cushioning material and the mountain parts formed on the second cushioning material are disposed facing each other. Thus, adhesive planes having the linear patterns disposed in the middle of the mountain parts and the valley parts of the respective cushioning materials can be disposed adjacent to each other substantially on the same plane. In the method for using the cushioning material in which the cushioning materials are disposed facing each other with the wavy-shaped concave-convex structures facing inward, the outer surfaces of the cushioning materials that are put on top of the other have flat shapes, and the adhesive layer formed as multiple islands exposed within a laminated plane may have functionality.

[0076]

The laminated body may be used as partition material or impact-absorbing wall panel material. If the wavy-shaped concave-convex structures face outward, the laminated body excels in design, and if the wavy-shaped concave-convex structures face each other inwardly, then the laminated body can have the flat surfaces and have functionality. The adhesive planes disposed adjacent to each other substantially on the same plane may form a plane having the functionality.

[0077]

According to the present invention, by joining the wavy shapes of the two cushioning materials, the cushioning materials can be used as the partition material or wall panel material inside public facilities. At this time, the two cushioning materials can have the adhesive planes arranged at the predetermined position of the wavy shapes in a substantially plane form, and thus, for example, if the adhesive planes are given with sound control or fire-resistant functions, it is possible to add, in addition to cushioning and sound proof features held by the resin foams, the vibration control or fire resistant functions held by the adhesive layers.

[0078]

Also, the adhesive planes of the cushioning materials that are put on top of the other have folded continuous curved shapes due to profile rolls before slice processing. However, after being slice-processed into the two cushioning materials, the cushioning materials are unfolded into plane shapes so that the slice-processed surfaces become the wavy-shaped concave-convex structures. This increases an apparent area of the wavy-shaped concave-convex structures of the cushioning materials. Thus, a rate of the total area of the adhesive planes formed at the

predetermined position of the slice-processed surfaces of the cushioning materials to the total area of the cushioning materials in the plane direction never reaches 100 %.

[0079]

That is, in planar view, the total apparent occupancy rate of the adhesive planes of the two cushioning materials disposed adjacent to each other on the substantially same plane to the total area is preferably high. If the total occupancy rate of the total area of the adhesive planes formed by putting the cushioning materials on top of the other to the area of the entire plane including the adhesive planes is 80 % or more, the functionality of the adhesive planes, when given thereto, can be fully displayed with certainty. Also, it is more preferable if the total apparent occupancy rate of the adhesive planes is 90 % or more.

[0080]

Also, the adhesive planes disposed adjacent to each other on the substantially same plane can have functionality. For example, sound control, fire-retardant, or design features can be given. As above, the single cushioning material can enhance decorative features using its design, and, when used double-layered, the functionality and the self-standing ability in assembling can be enhanced. However, even when used as the pair, it is also possible that the laminated body has emphasis on the design features.

[0081]

Such the laminated body can be used both the partitioning material and the wall panel material. At this time, joining the cushioning materials with the wavy-shaped concave-convex structures thereof facing opposite directions or facing each other can improve the self-standing ability in assembling when used as the partitioning material or sectioning material for the wall panel material.

[0082]

According to the fifth invention, by joining the wavy shapes of the two cushioning materials, the cushioning materials can be used as the partition material or the wall panel material inside public facilities. Also, when the faces formed with the wavy-shaped concave-convex structures face outward, the design feature thereof can be enhanced. Also, when the wavy-shaped concave-convex structures face each other, the two cushioning materials have their adhesive planes arranged at the predetermined positions of the wavy shapes on the substantially same plane, and thus the cushioning materials can display functionality if the adhesive planes are given with the functions.

[0083]

In particular, if the adhesive layer is given with noise reduction or vibration control functions, it is possible to add, in addition to cushioning features and sound proof functions held by the resin foams, the noise reduction or the vibration control functions held by the adhesive layers. Here, since the functionality is expected to be displayed on a condition that the two cushioning materials are joined to each other, the function that is given to the adhesive or fusion layer is preferably a physical function that can even display its effects at places other than an outermost surface of the resin foam.

[0084]

A sixth invention is a connection structure of shelter partitions using the laminated bodies according to the second invention. The laminated body is in a generally rectangular shape where a length of a longer side thereof is twice a length of a shorter side thereof. The two laminated bodies as a mat for disaster use that can be used as a bed are disposed on a floor surface, contacting the longer sides of the substantial rectangular shape thereof, so as to form a generally square section. The more laminated bodies stand in directions of the shorter sides thereof with the longer sides thereof contacting the floor surface so as to surround an outer periphery of the mat for disaster use as the generally square shaped floor material. A fixing means attached to an end part of the shorter side of the rear flat face of the laminated body is butted or fitted at substantially right angles with a fixing means attached to a flat part of a side end face of the shorter side. This is repeated a number of times to obtain a connection structure including at least a section having a sidewall formed into a generally square U shape with an open side.

[0085]

In the connection structure of the shelter partitions, to connect and fix the laminated bodies, any of button-type fasteners or magnets attached to a tape-like member, or a loop-and-hook fastener having multiple micro-protrusions on its surface may be used as fixing means that facilitate connection in assembling and separation in disassembling, and are attached to surfaces of the laminated bodies. The laminated body is light and weighs 5 kg or less, or usually 2 kg or less, and thus the laminated bodies can be fixed with simple fixing means.

[0086]

In the connection structure of shelter partitions using the laminated bodies, the laminated body may be cut in a straight line connecting positions of inflection points of the profile-processed surface of the laminated body so as to make a

substantially parallel area that occupies a cut section of an end face of the laminated body as large as possible, and the fixing means may be attached to a flat part of an end face of the shorter side, which is cut and formed into a generally rectangular shape.

Here, regarding that a distance between the adjacent mountain parts on a curve that alternately passes through top parts of the mountain parts and **top** parts of the valley parts of the profile-processed surface is one pitch, the laminated body is cut in a substantially straight line at a position a quarter pitch shifted from the top parts of the mountain parts or the bottom parts of the valley parts, that is in a substantially straight line connecting a plurality of positions of inflection points at mean positions between the top parts of the mountain parts and the bottom parts of the valley parts, or at mean positions between the bottom parts of the valley parts and the top parts of the mountain parts. Thus, it is possible to obtain a generally rectangular cut section in which a sectional area of a parallel part occupying the cut section of the end face of the laminated body is as large as possible.

[0087]

Along the above-mentioned curve that alternately passes through the top parts of the mountain parts and the **top** parts of the valley parts, the mountain parts and the valley parts are arranged in hound's tooth arrangement so as to intersect each other at right angles. Thus, a periodic structure of the mountain parts and the valley parts also has the same periodic structure in a direction intersecting the curve at right angles. Thus, by cutting the laminated body in a substantially straight line at a position a quarter pitch shifted from top parts of the mountain parts or the valley parts in a direction perpendicular to the above-mentioned curve, that is in a substantially straight line connecting the inflection points at the mean positions between the top parts of the mountain parts and the bottom parts of the valley parts, or at the mean positions between the bottom parts of the valley parts and the top parts of the mountain parts, it is also possible to obtain the cut section in which the sectional area of the parallel part occupying the cut section of the end face of the laminated body is as large as possible. As a result, it is possible to obtain the generally rectangular cut section in which the sectional area of the substantially parallel part occupying the cut section of the end face of the laminated body is as large as possible.

[0088]

When comparing the end part of the flat face and the side end face of the laminated body or the cushioning material, which are connected and fixed by the

fixing means, areas of the flat parts to which the fixing means are attached differ depending on the cutting position since the side end face includes the profile-processed face. So, by choosing to cut a section of the side end face having the largest parallel part area, the area of the cut section to which the fixing means such as loop-and-hook fasteners are attached can be maximized.

[0089]

In the connection structure of shelter partitions, the cushioning materials may be used instead of the laminated bodies.

[0090]

A seventh invention is a method for assembling the shelter partition using the laminated bodies according to the second invention. The method includes using the laminated body that is in a generally rectangular shape where a length of a longer side thereof is twice a length of a shorter side, disposing on a floor surface the two laminated bodies as a mat for disaster use that can be used as a bed to form a generally square section by contacting the longer sides of the generally rectangular shape of the two laminated bodies, standing the laminated bodies in directions of the shorter sides thereof with the longer sides thereof contacting the floor surface so as to surround an outer periphery of the mat for disaster use as the generally square shaped floor material, and connecting and fixing the laminated bodies by repeatedly butting and fitting at substantially right angles a fixing means attached to an end part of the shorter side of the rear flat face of the laminated body with a fixing means attached to a flat part of a side end face of the shorter side, and partitioning a section by forming a sidewall in a generally square U shape with an open side to obtain a shelter partition.

[0091]

The method for assembling the shelter partition may further include forming a generally square-shaped mat for disaster use as a flooring material for a second section adjacent to the mat for disaster use as the flooring material for a first section wherein the mat for disaster use for the second section, which can also be used as a bed, has the similar size as the mat for disaster use for the first section, and forming at least two U-shaped sections by using laminated bodies that are formed into another U-shaped sidewall having an opening in a direction opposite to the opening of the first section and sharing one end part side of the U shape with the first section so as to form the second section in succession to the first section.

[0092]

The method for assembling the shelter partition may further include, repeatedly forming the sidewall parts in turn by forming the U shapes with the openings of the generally square section being opened in opposite directions in turn, and repeatedly forming the generally square-shaped mat for disaster use as the generally square-shaped flooring material for each of the sidewall parts to form multiple sections.

[0093]

In the method for assembling the shelter partition, it is preferable that the flooring material is disposed with either the flat face or the face having the wavy-shaped concave-convex structure facing the floor surface, and the U-shaped wall parts are formed by the laminated bodies having the pattern-formed face with the wavy-shaped concave-convex structure and the opposite flat face alternating along each side of the section so that the laminated bodies are disposed facing outward, inward, and outward in turn, or inward, outward, and inward in turn. The flooring material can be disposed with either the flat face or the wavy-shaped concave-convex structure face of the laminated body facing the floor surface. Since the flooring material can also be used as a bed, a user may decide which face to use as an upper surface according to his/her personal preference. For example, the flooring material may be used with the wavy-shaped concave-convex structure face of the laminated body facing downward during the daytime, and may be used as a bed with the wavy-shaped concave-convex structure face of the laminated body facing upward during bedtime at night.

[0094]

In the method for assembling the shelter partition, connecting and fixing means are not limited as long as the connection and fixing means facilitate connection in assembling and separation in disassembling. For example, button-type fasteners or magnets fixed on a tape-like member attached to surfaces of the laminated bodies, or a loop-and-hook fastener having multiple micro-protrusions on its surface may be used to connect the laminated bodies. Here, a rear face of the loop-and-hook fastener is fixed to the laminated body by using a bonding agent or an adhesive agent, or the tape-like member attached with button-type fasteners or magnets can be fixed to the laminated body by using a bonding agent or an adhesive agent.

[0095]

In the method for assembling the shelter partition, the fixing means may be attached to predetermined positions from an upper end part to a lower end part of

the flat face of the laminated body, or to predetermined positions from an upper part to a lower part of the part corresponding to the flat part of the end face of the shorter side of the laminated body. The fixing means attached to the predetermined positions on the flat face and those attached to the flat part of the end face may be faced and butted to each other or faced and fitted to each other to be connected.

[0096]

In the method for assembling the shelter partition, regarding that a distance between the adjacent mountain parts on a curve that alternately passes through the top parts of the mountain parts and the bottom parts of the valley parts of the profile-processed surface is one pitch, the laminated body is cut in a substantially straight line at a position a quarter pitch shifted from top parts of the mountain parts or the valley parts, that is in a substantially straight line connecting mean positions between the top parts of the mountain parts and the bottom parts of the valley parts, or mean positions between the bottom parts of the valley parts and the top parts of the mountain parts, or, if these mean positions are inflection points, the laminated body is cut in a straight line connecting positions of the inflection points so as to make a substantially parallel area that occupies a cut section of the end face of the laminated body as large as possible, and the fixing means may be attached to the flat part of the shorter side end face formed in the generally rectangular shape. At this time, if the fixing means such as the loop-and-hook fasteners are fixed to the cut section where the parallel area that occupies the cut section of the end face is as large as possible, the laminated bodies can be fixed firmly.

[0097]

In the method for assembling the shelter partition, the cushioning material having the wavy-shaped concave-convex structure forming the linear patterns on the surface thereof according to the first invention may be used instead of the laminated body.

[0098]

According to the seventh invention, the shelter partitions can be assembled using the laminated bodies according to the second invention. The cushioning material having an entire outer surface of the same size and shape as the laminated body can also be used in the same way. Furthermore, when assembling the shelter partitions by using the method for assembling the shelter partitions of the present invention, the laminated body or the cushioning material of the present invention is light in weight, and thus even a child can easily assemble the shelter partitions

intuitively, without using any special tools, by simply viewing and checking the positions of the loop-and-hook fasteners.

[0099]

An eighth invention is a method for disassembling and storing the shelter partition formed by the method for assembling the shelter partition according to the seventh invention. The method includes attaching the fixing means at predetermined positions of both sides of the flat face of the laminated body, disposing the fixing means on a wall surface at predetermined positions corresponding to the positions of the fixing means disposed on the flat face, disassembling the shelter partition including the laminated bodies, facing the flat face of the laminated body toward the wall surface, fixing the fixing means on the first laminated body to the fixing means on the wall surface so as to fix the standing laminated body to the wall surface, placing a face with the wavy-shaped concave-convex structure of the second laminated body onto an opposite face of the flat face of the standing and fixed first laminated body, which has the wavy-shaped concave-convex structure, and aligning the end faces of the first laminated body and the second laminated body so as to make a pile of two layers, placing the flat face and the face with the wavy-shaped concave-convex structure, which are stacking surfaces respectively, of the third and fourth new laminated bodies standing in turn in the same way as in the case of the first and second laminated bodies while aligning the stacking surfaces and the end faces, further placing repeatedly the standing laminated bodies in the same procedure in turn according to the number of layers to be stacked, and attaching fixing means to predetermined positions of the end faces of the laminated bodies, and fixing the fixing means on the end faces of the laminated bodies to another fixing means having a predetermined length and being fixed on the wall surface.

[0100]

In the method for disassembling and storing the shelter partition, the fixing means used for disassembling and storing the laminated bodies may be the same fixing means used in assembling the laminated bodies, which facilitates separation in disassembling, and the fixing means may be any of button-type fasteners or magnets fixed on the tape-like member or the loop-and-hook fastener having multiple micro-protrusions on its surface. The rear face of the loop-and-hook fastener is fixed to the laminated body by using a bonding agent or an adhesive agent, or the tape-like member attached with button-type fasteners or magnets can be fixed to the laminated body by using a bonding agent or an adhesive agent.

[0101]

In the method for disassembling and storing the shelter partition, regarding that a distance between the adjacent mountain parts on a curve that alternately passes through the top parts of the mountain parts and the bottom parts of the valley parts of the profile-processed surface is one pitch, the laminated body is cut in a substantially straight line at a position a quarter pitch shifted from the top parts of the mountain parts or the bottom parts of the valley parts, that is in a substantially straight line connecting the mean positions between the top parts of the mountain parts and the bottom parts of the valley parts, or the mean positions between the bottom parts of the valley parts and the top parts of the mountain parts, or, if these mean positions are inflection points, the laminated body is cut in a straight line connecting positions of the inflection points so as to make a substantially parallel area that occupies a cut section of the end face of the laminated body as large as possible, and the fixing means may be attached to the flat part of the shorter side end face formed in the generally rectangular shape. At this time, if the fixing means such as the loop-and-hook fasteners are fixed to the cut section where the parallel area that occupies the cut section of the end face is as large as possible, the fixing means on the end face of the laminated body can be firmly fixed to the other fixing means having the predetermined length, which is fixed to the wall surface.

[0102]

In the method for disassembling and storing the shelter partition, the cushioning material having the wavy-shaped concave-convex structure forming the linear patterns on the surface thereof according to the first invention may be used instead of the laminated body.

[0103]

According to the eighth invention, the shelter partitions assembled by the seventh invention can be disassembled and stored. Also in this method for disassembling and storing the shelter partition, the cushioning material having an entire outer surface of the same size and shape as the laminated body can also be used in the same way. Also in the method for disassembling and storing shelter partitions according to the eighth invention, the laminated body or the cushioning material of the present invention is light in weight, and thus even a child can easily disassemble and store the shelter partitions intuitively, without using any special tools, by simply viewing and checking the positions of the loop-and-hook fasteners.

[0104]

A ninth invention is a method for forming an impact-absorbing wall panel using the laminated bodies used in the method for assembling the shelter partition according to the seventh invention. The method includes attaching the fixing means at predetermined positions of both sides of the flat face of the laminated body, disposing the fixing means on the wall surface at predetermined positions corresponding to the positions where the fixing means are arranged on the flat faces of the laminated bodies when the shorter sides of the laminated bodies as the standing faces are disposed in sequence parallel to the wall surface so that the longer side directions of the laminated bodies are adjoined to each other, disassembling the shelter partition including the laminated bodies, fixing the laminated body with the flat face thereof facing toward the wall surface and the wavy-shaped concave-convex structure face thereof facing toward an interior of a room by the fixing means disposed at the predetermined positions of the wall surface, corresponding to the positions where the fixing means of the laminated body are arranged, facing the flat face of the other laminated body toward the wall surface, similarly fixing the other laminated body with the wavy-shaped concave-convex structure face thereof facing the interior of the room by the fixing means disposed at the predetermined positions of the wall surface, corresponding to the positions where the fixing means of the laminated body are arranged, in succession to the first fixed laminated body, and further fixing the other laminated bodies one after the other to the wall surface in succession to the laminated body that has been fixed immediately ahead so as to form the impact-absorbing wall panel for the shelter.

[0105]

In the method for forming the impact-absorbing wall panel for shelters using the laminated bodies used in the method for assembling the shelter partition, the fixing means used for disassembling the laminated bodies and forming the impact-absorbing wall panel may be the same fixing means used in assembling the laminated bodies, which facilitates connection in assembling and separation in disassembling, and the fixing means may be any of button-type fasteners or magnets fixed on the tape-like member or the loop-and-hook fastener having multiple micro-protrusions on its surface. The rear face of the loop-and-hook fastener is fixed to the laminated body by using a bonding agent or an adhesive agent, or the tape-like member attached with button-type fasteners or magnets can be fixed to the laminated body by using a bonding agent or an adhesive agent.

[0106]

In the method for forming the impact-absorbing wall panel, the cushioning material having the wavy-shaped concave-convex structure forming the linear patterns on the surface thereof according to the first invention may be used instead of the laminated body.

[0107]

The ninth invention can provide the method for forming the impact-absorbing wall panel for shelters. Also, if the cushioning materials are used instead of the laminated bodies in the method for forming the impact-absorbing wall panel for shelters using the laminated bodies for shelter partitions, the same effects as the laminated bodies can be obtained.

[0108]

According to the fourth to ninth inventions, the shelter partitions and the like having excellent design using the cushioning materials or the laminated bodies can be assembled without using any tools or assembling components. Also, since the cushioning materials or the laminated bodies are light in weight, assembling is easy for even elderly or young people. For the same reason, the shelter partitions can also be easily disassembled in a short time and easily stored on the wall surfaces. Furthermore, the shelter partitions can be disassembled and easily formed into the impact-absorbing wall panels on the wall surfaces of the shelters. That is, the cushioning materials or the laminated bodies can be used as the impact-absorbing wall panel on the shelter wall surfaces during normal time and can be used as both the shelter partitions and flooring materials during the time of emergency.

[0109]

The cushioning material and the laminated body used in these inventions are made of polyolefin resin foam, in which the fusion plane or the adhesive plane is colored so that the linear patterns are successfully formed on the wavy-shaped concave-convex structure, and are light in weight and excel in design, thermal insulation, impact absorbance, and moisture proof. It is also possible to give the adhesive layer or the fusion layer functionality such as vibration control and sound proof functions. Also, if the laminated body has the predetermined size and shape, the laminated body excels in assembling operation of the shelter partitions, and thus the shelter partitions that can be easily assembled without using assembling tools or components can be obtained. Furthermore, as mentioned above, the connection structure of the shelter partitions, the method for assembling, disassembling, and storing the shelter partition using the laminated bodies, and the method for forming the impact-absorbing wall panel in shelters can be obtained.

(EFFECTS OF THE INVENTION)

[0110]

The present invention can provide a lightweight cushioning material having excellent design with linear patterns on a wavy-shaped concave-convex structure face, wherein the cushioning material is formed of polyolefin resin foam having an adhesive layer or a fusion layer that can have vibration control or soundproof functions, a laminated body using the cushioning material, methods for manufacturing the cushioning material and the laminated body, a method for using the cushioning material, a connection structure of shelter partitions that can be easily assembled by using the laminated bodies without using assembly tools or components, a method for assembling the shelter partition using the laminated bodies, a method for disassembling and storing the shelter partition, and a method for forming impact-absorbing wall panels for the shelter partition.

BRIEF DESCRIPTION OF DRAWINGS

[0111]

FIG. 1A is a perspective view of a front face side of a cushioning material 1.

FIG. 1B is a perspective view of a rear face side of the cushioning material 1.

FIG. 2 is a plan view showing the cushioning material 1.

FIG. 3 is a cross sectional view of the cushioning material 1 taken along A-A line in FIG. 2.

FIG. 4 is a schematic view showing a resin foam manufacturing device 20.

FIG. 5A is a front view showing a roll 31a and a roll 31b.

FIG. 5B is a side view of the roll 31a and the roll 31b.

FIG. 6A is a view showing a method for manufacturing the cushioning material 1 by using the roll 31a and the roll 31b.

FIG. 6B is an enlarged view of section C in FIG. 6A.

FIG. 7 is a cross sectional view of a laminated body 1a.

FIG. 8A is a view showing a state in which the cushioning materials 1 are disposed facing each other.

FIG. 8B is a cross sectional view of a laminated structure 40.

FIG. 9A is a view showing a state in which the cushioning materials 1 are disposed with surfaces of wavy-shaped concave-convex structures thereof facing outward.

FIG. 9B is a cross sectional view of a laminated structure 40a.

FIG. 10 is a cross sectional view of the laminated structure 40 taken along F-F line

in FIG. 8B.

FIG. 11 is a plan view showing a cushioning material 1c.

FIG. 12A is a plan view showing a cushioning material 1d.

FIG. 12B is a side view showing the cushioning material 1d.

FIG. 13 is a view showing a shelter partition 50.

FIG. 14A is a view showing cutting positions of the laminated body viewed from a profile-processed surface thereof, which shows a relationship between the cutting positions and cross sectional shapes of side faces of cut end portions of the laminated body.

FIG. 14B is a view showing a cut section of the laminated body when the laminated body is cut along a curved line passing through top parts of the mountain parts and bottom parts of the valley parts in turns.

FIG. 14C is a view showing a cut section of the laminated body when the laminated body is cut along a straight line connecting positions of inflection points that are quarter pitch away from the top parts of the mountain parts and the bottom parts of the valley parts.

FIG. 15A is a front view showing a method for storing the cushioning materials 1.

FIG. 15B is a plan view showing the method for storing the cushioning materials 1.

FIG. 16A is a front view showing an impact-absorbing wall panel 60.

FIG. 16B is a plan view showing the impact-absorbing wall panel 60.

FIG. 16C is an enlarged view of proximity of hook-and-loop fasteners 53c and 53d.

FIG. 17 is a view showing a state of an evaluation test for self-standing ability in assembling of partitioning partitions in which the partitions are connected at substantially right angles.

FIG. 18A is a view showing dimensions of parts of the partitioning partitions.

FIG. 18B is a view showing a state in which mountain parts 5a are turned over to face with valley parts 7a.

FIG. 18C is a view showing a state in which the mountain parts 5a are turned over to fit with the valley parts 7a.

DESCRIPTION OF SOME EMBODIMENTS

[0112]

(First Embodiment)

Hereinafter, some embodiments of the present invention will be described with reference to the accompanying drawings. FIG. 1A is a perspective view of a front face of a cushioning material 1, FIG. 1B is a perspective view of a rear face of the

cushioning material 1, and FIG. 2 is a schematic plan view showing the cushioning material 1.

[0113]

The cushioning material 1 is formed of polyolefin resin foam. One face of the cushioning material 1 (a front face 3) has mountain parts 5 and valley parts 7 being formed. The mountain parts 5 and the valley parts 7 are disposed periodically and alternately in vertical and horizontal directions. That is, the front face 3 of the cushioning material 1 has a wavy-shaped concave-convex structure, in which the mountain parts 5 are formed at predetermined intervals and the valley parts 7 are formed between the mountain parts 5 so that the mountain parts 5 and the valley parts 7 are in a so-called hound's-tooth arrangement. Thus, the valley part 7 is formed at a part that is vertically or horizontally adjacent to the mountain part 5, and the mountain part 5 is formed at a part that is vertically or horizontally adjacent to the valley part 7.

[0114]

Also, the other face of the cushioning material 1 (a rear face 9) is a flat face without the mountain parts 5 and the valley parts 7 being formed. That is, the cushioning material 1 has the mountain parts 5 and the valley parts 7 only on the front face 3.

[0115]

FIG. 3 is a cross sectional view taken along A-A line in FIG. 2. As shown in the drawing, the mountain part 5 is a thick part and the valley part 7 is a thin part. A ridge having an approximately mean thickness between a thickness of the mountain part 5 and a thickness of the valley part 7 is formed between the two diagonally adjacent mountain parts 5 (or two diagonally adjacent valley parts 7). That is, the wavy-shaped concave-convex structure of the front face of the cushioning material 1 is formed continuously and smoothly in this way.

[0116]

Also, the cushioning material 1 is a laminate of a resin foam 15a forming the mountain parts 5 and a resin foam 15b forming the valley parts 7, and includes an adhesive layer 17 that is formed between lamination planes of the resin foams 15a and 15b. Hereinafter, although examples in which the adhesive layer 17 is formed between the lamination planes of the resin foams 15a and 15b will be described, the adhesive layer 17 may be replaced with a fusion layer. When not colored, the adhesive layer, as well as the fusion layer, is recognized as being white colored, which is almost the same color as the resin foams 15a and 15b. A cross section of the

cushioning material cannot usually be seen, and thus the colored adhesive layer or the fusion layer is seen as multiple ring-shaped linear patterns as described below.

[0117]

When the adhesive layer 17 made of an adhesive agent is formed between the lamination planes of the resin foams 15a and 15b, the adhesive agent including at least one of flexible resin selected from a group consisting of urethane resin, vinyl acetate emulsion, acrylic resin, silicone resin, and modified silicone resin as a main component can be used. In particular, using an adhesive agent including at least one of flexible resin selected from a group consisting of urethane resin, silicone resin, and modified silicone resin as a main component can give a vibration control function to the cushioning material 1. The adhesive agent including acrylate ester copolymer, halogenated phosphate ester, and inorganic flame retardant as essential components may also be used as the adhesive layer 17. This can give flame-retardant and vibration control functions to the cushioning material 1. As above, the wavy-shaped concave-convex structure of the cushioning material 1 may have the adhesive layer 17 (or the fusion layer) with functionality.

[0118]

The adhesive layer 17 formed substantially parallel to the rear face 9 is exposed to a part that is at a predetermined height of the wavy-shaped concave-convex structure of the front face 3. The adhesive layer 17 forms multiple ring-shaped linear patterns 11 that are predetermined intervals apart from each other in planar view. The linear pattern 11 separates the mountain part 5 and the valley part 7 of the wavy-shaped concave-convex structure and is formed in a ring shape at the predetermined height between the mountain part 5 and the valley part 7 so as to surround each mountain part 5, while having excellent design and moisture-proof features. That is, the front face 3 of the cushioning material 1 is divided into three sections: the mountain parts 5 formed of the resin foam 15a on an upper side of the linear patterns 11, a linear pattern formation part 13 where the linear patterns 11 are formed, and the valley parts 7 formed of the resin foam 15b at a lower side of the linear pattern 11. The valley part 7 joins continuously with the other adjacent valley part 7 to be integrated.

[0119]

The resin foams 15a and 15b are preferably formed of at least any one of polyethylene, low-density polyethylene, high-density polyethylene, ethylene-vinyl acetate copolymer, or polypropylene resin, or a mixture of two or more of the above. At this time, a foaming ratio of the resin foams 15a and 15b is preferably between

20 and 40 times. In particular, the resin foams 15a and 15b are preferably made of polyethylene resin. It is preferable that a permanent compression set according to JIS K6767 of this polyethylene resin is between 3.0 % and 7.4%, and a compression stress thereof at a test temperature of 25 °C at the time of 25 % compression is between 34 kPa and 56 kPa.

[0120]

The compression stress of the resin foams 15a and 15b is measured in a test for compression stress by compression stress strain according to ISO 3386-1 in JIS K6767:1999. At this time, the compression stress at the time of 25 % compression of the material thickness is measured with a moving speed of the compression plate of the test machine of approximately 50 % of a thickness of the material per minute and a test temperature of 25 °C.

[0121]

Also, the permanent compression set of the resin foams 15a and 15b is measured in a test according to ISO 1856 in JIS K6767:1999. A test piece is compressed until being 25 % strained and left in a temperature of 23 °C ± 2 °C for 22 hours, and its thickness after 24 hours following the completion of compression is measured to obtain the permanent compression set.

[0122]

Forming the resin foams 15a and 15b from polyethylene resin can reduce moisture absorbance (water absorption) of the cushioning material 1. The water absorption of the resin foams 15a and 15b is measured by method B of ISO2896. In a case of a test piece having a skin layer(s) on both or one side(s) thereof, the water absorption can be found by the following formula:

$$Q_s = (W1 - W2) / A$$

where Q_s represents water absorption (g/cm²), $W1$ represents a mass (g) of the test piece that is cut into a size of 100mm by 100mm, $W2$ represents a mass (g) of the test piece after being dried at 60 °C for 24 hours, and A represents an area (cm²) of the test piece. The water absorption of polyethylene in the present invention is preferably 0.03 mg/ cm² or less.

[0123]

Also, a tensile strength in machine direction (MD) of the resin foams 15a and 15b is preferably between 273 kPa and 495 kPa, and a tensile strength in transvers direction (TD) thereof is between 201 kPa and 333 kPa. Also, an MD elongation of the resin foams 15a and 15b is preferably between 92 % and 100 %, and a TD elongation thereof is preferably between 114 % and 120 %. The tensile strength and

elongation can be obtained from tensile strength and elongation at break in a test performed under ISO1798 with a test speed of 500 mm/min.

[124]

Also, the resin foams 15a and 15b may include, as a deodorant agent, any of silica, zirconium phosphate, zeolite, zinc sulfate, or zirconium sulfate in a range between 0.5 pts.mass and 5 pts.mass within 100 pts.mass of the resin component. Deodorant function can be added by including such a deodorant agent in this way.

[0125]

Next, a method for manufacturing the cushioning material 1 will be described. First, the resin foams 15a and 15b are manufactured. FIG. 4 is a view showing a resin-foam manufacturing device 20. The resin-foam manufacturing device 20 mainly includes an extruding machine 21, a roll-forming machine 23, a heating furnace 25, a winding-up machine 27, and so on.

[0126]

For example, a masterbatch including a raw resin (polyethylene resin, for example), pigment, chemical foaming agent, and crosslinking agent is put into the extruding machine 21 to be extruded into a sheet shape with a predetermined width. Next, the material is passed through the roll-forming machine 23 to adjust its thickness and width. Then, the material is conveyed inside the heating furnace 25 on a metal-made conveyer, where a temperature rises gradually within a predetermined range (between 190 °C and 240 °C, for example) as going further inside the furnace. In the heating furnace 25, the crosslinking agent is thermally decomposed first to crosslink the polyethylene resin, and then the chemical foaming agent is thermally decomposed to obtain the resin foams 15a and 15b having a predetermined foaming ratio (30 times, for example) and a predetermined sheet thickness (preferably between 15 mm and 20 mm).

[0127]

In manufacturing the resin foams 15a and 15b, DCP (dicumyl peroxide) can be used as the crosslinking agent. At this time, ADCA can be used as the chemical foaming agent without using a bubble-nucleating agent. In general, for a nucleating agent, physical nucleating agent such as monosodium citrate, surfactant, silicone oil or the like and carbon dioxide gas may be used. To change the color of the fusion layer into yellow, ADCA is preferably used as the chemical foaming agent.

[0128]

Next, the obtained resin foams 15a and 15b are laminated by fusion or adhesion. The thicknesses of the resin foams 15a and 15b that are to be adhered or

fusion bonded may be the same or may be different from each other.

[0129]

For example, adhesive agent is applied to each face of the resin foams 15a and 15b, and then opposite faces with no adhesive agent applied are pressed by a press to join the two resin foams. Alternatively, one of the resin foams 15a and 15b is passed through a roll that is applied with adhesive agent to apply the adhesive agent to the resin foam, and then the other resin foam is stacked onto an attaching face, to which the adhesive agent is applied, and the stacked resin foams are passed through another roll to join the two resin foams. At this time, the adhesive agent can be colored by using organic dye, dye color, or pigment. Alternatively, at least one of adhering planes can be colored by using organic dye, dye color, or pigment. Also, in a case of heat fusion of the resin foams 15a and 15b, the resin foams 15a and 15b are heated by a far infrared heater up to about 180 °C for approximately 10 to 20 seconds and then passed through the roll to be joined by heat fusion. Here, fusion planes can be colored by using organic dye, dye color, or pigment similarly as in the adhesion. Also, resin on the resin foam surfaces and the fusion bonding part are melted and crystalized once again at the time of fusion bonding. By superimposing this crystallization state, the change in molecule weight, effects that residuals of ADCA are likely to remain on the surface, and the like, the fusion bonding part can be colored into yellow.

[0130]

Next, a profile processing is performed onto the sheet-shaped resin foams having the predetermined thickness and facing each other with the adhesive layer therebetween (hereinafter, a laminated resin foam). FIG. 5A is a front view showing a roll 31a and a roll 31b that are profile rolls used for profile-processing the cushioning material 1. FIG. 5B is a side view showing the rolls 31a and 31b. The roll 31b has the same structure as the roll 31a and its description will be omitted.

[0131]

The roll 31a includes a plurality of convex portions 33 formed on a surface of the cylindrical roll. The convex portions 33 are disposed in a hound's tooth arrangement on the surface of the roll 31a. That is, the convex portions 33 are formed at predetermined intervals (a predetermined pitch) in a longitudinal direction of the roll 31a, and the convex portions 33 that are adjacent to each other in a circumference direction are formed at positions that are half pitch shifted from the above-mentioned arrangement pitch. A part that is surrounded by the convex portions 33 becomes a concave portion 35. The concave portion 35 is slightly bigger

than the convex portion 33, and the convex portion 33 and the concave portion 35 facing each other can engage with each other.

[0132]

The rolls 31a and 31b are disposed being a predetermined distance apart from each other and facing each other. The distance between the rolls 31a and 31b is adjustable. At this time, the rolls 31a and 31b are disposed in the circumference direction so that positions of the convex portions 33 and the concave portions 35 of the facing rolls 31a and 31b do not match each other, respectively.

[0133]

That is, in a state in which the rolls 31a and 31b are arranged facing each other, when the convex portions 33 of the upper roll 31a are positioned at the lowest edge (a side facing the roll 31b), the concave portions 35 are positioned at the highest edge of the lower roll 31b (a side of the roll 31a) in a cross sectional position in the circumference direction (as shown in FIG. 5B, for example). Also, rotation of each roll is controlled and synchronized so that such position arrangement is repeated alternately. The convex portions 33 and the concave portions 35 are also arranged in the longitudinal direction of the rolls 31a and 31b so as not to match each other but to be alternating.

[0134]

FIG. 6A is a view showing a state in which the cushioning material 1 is manufactured by using the rolls 31a and 31b. As mentioned above, the roll 31a is arranged the predetermined distance apart from the roll 31b. The rolls 31a and 31b rotate in counter directions to each other (directions shown by arrows D in the drawing), and a laminated resin foam 39 is inserted between the rolls 31a and 31b from one end thereof. The laminated resin foam 39 is formed of the resin foams 15a and 15b that are laminated and adhered or fusion bonded with each other as mentioned above.

[0135]

Here, the laminated resin foam 39 is formed of the resin foams 15a and 15b, having the same foam ratio and sheet thickness, that are laminated and adhered or fusion bonded with each other as mentioned above. The laminated resin foam 39 is engaged between the rolls 31a and 31b and passed progressively to a rear side (in a direction shown by an arrow E in the drawing). A cutting blade 37 is provided at a slightly rear side of an engaging part between the roll 31a and 31b. The cutting blade 37 cuts the laminated resin foam 39 in a direction perpendicular to the thickness direction, having a width that is at least larger than a width of the

laminated resin foam 39. The laminated resin foam 39 is passed toward the rear side of the rolls 31a and 31b while being pressed (deformed) by the rolls 31a and 31b and then cut by the cutting blade 37 in the direction perpendicular to the thickness direction while being deformed by the rolls 31a and 31b.

[0136]

FIG. 6B is an enlarged view of a section C in FIG. 6A. The convex portions 33 and the concave portions 35 of the rolls 31a and 31b elastically deform the laminated resin foam 39. As mentioned above, the rolls 31a and 31b rotate so that the positions of the convex portions 33 (the concave portions 35) of the roll 31a and the positions of the concave portions 35 (the convex portions 33) of the roll 31b alternate with each other. Thus, the laminated resin foam 39 has a wavy shape as if threading through the convex portions 33 and concave portions 35 of the upper roll 31a and the convex portions 33 and concave portions 35 of the lower roll 31b.

[0137]

The cutting blade 37 cuts the laminated resin foam 39 when the laminated resin foam 39 is in the wavy-shape state. At this time, the cutting blade 37 is disposed at a substantially center of the thickness direction of the laminated resin foam 39 (at the middle position between the rolls 31a and 31b). However, at a part where the laminated foam resin 39 is actually cut, the laminated resin foam 39 is deformed into the wavy shape. For this reason, the cutting blade 37 cuts the laminated resin foam 39 into a wavy shape to the thickness direction thereof rather than in a straight line at the middle of the thickness direction.

[0138]

Here, the laminated resin foam 39 includes the adhesive layer 17 formed inside thereof. Thus, when the laminated resin foam 39 deforms into the wavy shape, the adhesive layer 17 also deforms upward and downward repeatedly into a wavy shape while forming a centerline for the laminated resin foam 39. The cutting blade 37 cuts the laminated resin foam 39 as if cutting across the wavy-shaped adhesive layer 17.

[0139]

The cut laminated resin foam 39 is then passed to the rear side of the rolls 31a and 31b while being restored from the deformation by the rolls 31a and 31b (the convex portions 33 and concave portions 35) into its original shape. At this time, the part cut by the cutting blade 37 is restored into the wavy shape. Thus, the mountain parts 5 and the valley parts 7 are formed at a cutting plane of the laminated resin foam 39. That is, with the cutting blade 37 as a center, a part that is deformed into

the concave portion 35 of the roll becomes the mountain part 5 of the cushioning material 1, and a part that is pressed by the convex portion 33 of the roll becomes the valley part 7 of the cushioning material 1. That is, a plane where the rolls 31a and 31b meet becomes flat-shaped, and, on the other hand, the cutting plane has the wavy-shaped concave-convex structure in which the mountain and valley parts are alternately and periodically arranged in vertical and horizontal directions, matching the pitch of the concave-convex parts of the rolls 31a and 31b.

[0140]

As above, in the present embodiment, after passing through the rolls 31a and 31b which are profile rolls, the laminated resin foam 39 goes under slice-processing to be cut at a position including the adhesive layer 17 (or the fusion layer, the same applies hereafter) before pressing force applied by the upper and lower rolls 31a and 31b is not elastically restored. In this way, the laminated resin foam 39 is cut as if cutting across the bent adhesive layer 17 while the adhesive layer 17 is in a curved state. Thus, when the cut and separated laminated resin foam 39 elastically restores and the adhesive layer 17 is formed at a flat face with a predetermined length and shape, the adhesive layer 17 is exposed at a part at a predetermined height from the surface between the mountain part 5 and the valley part 7 of the wavy-shaped concave-convex structure of the laminated resin foam 39, forming periodic hound's-tooth patterns of the cushioning material 1 in longitudinal and width directions of the rolls as exposed parts of the flat face. In this way, a pair of the cushioning materials 1 each having the wavy-shaped concave-convex structure formed by profile processing are formed.

[0141]

The cushioning material 1 obtained as above can be used as a mat material for disaster use, which can be used, for example, as a bed with the wavy-shaped concave-convex structure formed surface (the front face 3) as an upper face and the other surface (the rear face 9) as a lower face.

[0142]

As above, according to the present embodiment, the cushioning material 1 having the front face 3 on which the wavy-shaped concave-convex structure is formed and the flat rear face 9 can be obtained. At this time, the multiple ring-shaped linear patterns 11 are formed in hound's tooth arrangement at the predetermined height of the mountain parts 5 of the wavy-shaped concave-convex structure, and thus improving design features. Also, such the cushioning material 1 can be obtained by profile-processing the laminated resin foam 39 so its

manufacturability is good. Although details will be described below, coloring at least one of the laminated resin foams 15a and 15b, or coloring both the resin foams 15a and 15b with different colors, can form three-dimensional patterns in which sides of the mountain parts 5 and sides of the valley parts 7 (including bottom parts) of the wavy-shaped concave-convex structure are colored differently from the linear pattern formation part 13 with the linear patterns 11 (the adhesive layer 17) as a boundary surface.

[0143]

Although the cutting blade 37 is disposed at the substantially middle position between the rolls 31a and 31b (at the substantially center of the thickness direction of the laminated resin foam 39 to be cut) in the illustrated examples, it is not limited thereto. For example, a height at which the slicing process is performed at an exit side of the rolls can be adjusted by moving the cutting position vertically for a predetermined distance within a height range between the forming positions of the mountain parts 5 and the valley parts 7 of the wavy shape of the adhesive layer 17 (within a range of a width (height) of the curves formed on the adhesive layer or the fusion layer in the laminated resin foam 39), which is engaged between the rolls 31a and 31b. Alternatively, with the cutting blade 37 being disposed at the substantially middle position between the rolls 31a and 31b, the forming position of the adhesive layer 17 of the laminated resin foam 39 may be shifted from the center of the thickness of the laminated resin foam 39 by increasing a sheet thickness of one of the resin foams 15a and 15b.

[0144]

This can change an area ratio of the mountain parts 5 to the valley parts 7 of the cut wavy-shaped concave-convex structure. As a result, the linear patterns 11 and size of the three-dimensional patterns formed by the adhesive layer 17 can be adjusted. Changing the area of the mountain parts 5 formed by the resin foam 15b or changing the area ratio of the valley parts 7 formed by the resin foam 15a in this way can remarkably change the three-dimensional design quality and texture, in which at least one of the resin foams 15a and 15b is colored. Thus, by adjusting the forming positions of the mountain parts 5 and valley parts 7 of the wavy-shaped concave-convex structure to adjust the size of the multiple ring-shaped linear patterns 11, a pair of the cushioning materials 1 having the linear patterns 11 of different sizes can also be obtained.

[0145]

Also, if the resin foams 15a and 15b are made of polyethylene, which has a low

moisture absorption, it is possible to improve moisture-proof features of the mat or the like using the cushioning material 1. Thus, since the cushioning material 1 does not absorb moisture and formed of a foam material by profile processing, the cushioning material used as a mat at the time of disaster can be used as a bed that can provide comfortable sleep and living environment.

[0146]

Also, other functionality can be added to the adhesive layer 17. For example, vibration control or flame-retardant functions can be given. Furthermore, the resin foams 15a and 15b may be given with a deodorant function.

[0147]

Other than the above, the laminated body, as described below, may be formed by attaching flat resin foams 15c and 15d to the cushioning material 1, which is formed by slice-processing a double-layered resin foam, after the roll molding.

[0148]

(Second Embodiment)

Next, a second embodiment will be described. FIG. 7 is a cross sectional view showing a laminated body 1a in which a sheet-shaped resin foam is fusion bonded or adhered to a rear face of a cushioning material. In descriptions hereinafter, the same notations as in FIG. 1A to FIG. 6B will be used for the same structures of the cushioning material 1, and redundant descriptions will be omitted.

[0149]

The laminated body 1a has approximately the same structure as the cushioning material 1 except that the sheet-shaped resin foam 15c is laminated thereon by fusion bonding or adhering the resin foam 15c to the rear face of the cushioning material 1. The laminated body 1a includes a separate sheet of the resin foam 15c that is further laminated by adhering or fusion bonding onto the flat face, which is the other rear face of the formed surface having the wavy-shaped concave-convex structure of the cushioning material 1. The laminated body 1a may have another sheet-shaped resin foam further adhered or fusion bonded onto the rear face 9 thereof. However, one layer of a sheet-shaped resin foam that is fusion bonded or adhered is usually sufficient.

[0150]

At this time, the sheet-shaped resin foam 15c that is fusion bonded or adhered to the rear face of the cushioning material preferably has a harder strength than or equivalent strength to that of the resin foams 15a and 15b having the wavy-shaped concave-convex structure. Here, if the sheet-shaped resin foam 15c that is fusion

bonded or adhered to the rear face of the cushioning material is a resin having a lower foaming ratio than that of the resin foams 15a and 15b, self-standing ability in assembling of the laminated body when used as partitioning partitions, which will be described below, can be improved.

[0151]

A method for manufacturing the laminated body 1a is not limited in particular. For example, the rolls 31a and rolls 31b shown in FIG. 5A and FIG. 5B may be used to cut a four-layered laminated resin foam. First, two sheet-shaped resin foams that face each other having predetermined thicknesses are adhered or fusion bonded to each other, interposing an adhesive layer or a fusion layer, and another sheet-shaped resin foam layer is adhered or fusion bonded onto each of outer sides, i.e. opposite sides of the adhesive layer or the fusion layer, of the resin foams to form a four-layered laminated resin foam. In this case, a roll distance between the roll 31a and the roll 31b is adjusted and slice-processing is performed between the second and third layers in the middle, leaving out upper and lower outer layers (the first and fourth layers) so that the similar process as in the case of the two-layered laminated resin foam 39 can be performed. As a result, it is possible to obtain the laminated body 1a and a laminated body 1b in which the flat resin foams 15c or the flat resin foams 15c and 15d are attached onto the flat rear faces of the resin foam 15b with the wavy-shaped concave-convex structure formed with the periodic linear patterns 11 on the front face thereof.

[0152]

As above, by performing the slice-processing between the second and third layers in the middle while keeping the curved shape formed by the profile roll processing inside the resin foam layers that form two inner layers out of the four layers, the laminated body in which the flat sheet-shaped foam resin layer is integrated onto an outer layer of the profile-processed inner resin layer can be manufactured.

[0153]

According to the second embodiment, the same effects to improve design as in the first embodiment can be obtained. Also, laminating the resin foam 15c or the like can provide the laminated body 1a or 1b having a larger thickness, and cushioning features can be enhanced. Also, with the thicker thickness, the self-standing ability in assembling of the laminated body as well as the moisture-proof function can be improved.

[0154]

At this time, the laminated bodies 1a and 1b can have a heat-insulating function, cushioning features, and a moisture-proof function in addition to excellent design with the periodic patterns of the wavy-shaped concave-convex structure on the front face thereof. Furthermore, the sheet-shaped resin foams 15c and 15d increase the thicknesses of the laminated bodies 1a and 1b, and thus the self-standing ability in assembling thereof is also improved. Thus, as described below, the laminated body can stand easily on itself when used as a partitioning wall in shelters. Moreover, the laminated bodies 1a and 1b are light in weight and end side faces of the laminated bodies 1a, 1b can be fixed with flat portions of the laminated bodies 1a, 1b by using hook-and-loop fasters, for example, and thus the partitioning walls in shelters can be formed easily without using tools or assembly components. Thus, the laminated bodies 1a and 1b can be suitably used as partitioning members in shelters.

[0155]

Moreover, changing the colors of the foam bodies on the upper and lower sides of the fusion or adhesive planes of the wavy-shaped concave-convex structures of the laminated bodies 1a and 1b can further improve the design features. Thus, when used as partitioning members for partitioning walls or floor mats in shelters, the floor mat can also be used as a bed because of its thermal insulation, cushioning, and moisture-proof functions, and the mat also has effects of not only maintaining comfortable living environment in the shelters but also helping people living in the shelters feel light hearted as well.

[0156]

Also, since the sheet-shaped resin foam 15c or the like to be laminated has harder or equivalent strength compared to that of the resin foams 15a and 15b having the wavy-shaped concave-convex structure, when the laminated body 1a or 1b is used as a mat, it is possible to suppress excessive sinking while maintaining the cushioning features. That is, taking a mat material as an example, the lightweight mat material that is excellent in design, moisture-proof, and thermal insulation can be obtained, and the mat material can be used being exposed on the floors of gymnasiums or the like in the area struck by disaster. As above, the laminated bodies 1a and 1b can suppress excessive sinking while maintaining the cushioning features and excelling in the moisture-proof function, and thus the laminated body 1a or 1b can be used as a bed, and can be suitably used as a mat material that also serves as a bed in the shelters. Also, if the laminated bodies 1a and 1b have the predetermined size and shapes, the laminated bodies 1a and 1b can

be used as partitioning partitions that are excellent in self-standing ability in assembling as described below.

[0157]

(Third Embodiment)

Next, a third embodiment will be described. FIG. 8A is a view showing a state in which the cushioning materials 1 are disposed facing each other. The pair of the cushioning materials 1 are disposed so that the faces with the wavy-shaped concave-convex structures face each other. The present embodiment is related to a method for using the cushioning material 1 in which the two cushioning materials 1 are put on top of the other so as to be used as a laminated structure of the cushioning materials 1. Here, the laminated structure means a structure in which the cushioning materials are put on each other where fusion bonding or adhesion of the laminated part is not necessary: the flat faces of the cushioning materials may be fixed to each other by hook-and-loop fasteners, or the faces with the wavy-shaped concave-convex structures of the cushioning materials may simply face each other.

[0158]

FIG. 8B is a view showing a laminated structure 40 in which the pair of the cushioning materials 1 are laminated joining the mountain parts and the valley parts with each other. That is, FIG. 8B is a view showing the method for using the cushioning materials in which the two cushioning materials 1 are put on top of each other and laminated. Mountain parts 5a formed on one of the cushioning material 1 (the lower one in the drawing, the first cushioning material) are disposed facing valley parts 7b formed on the other cushioning material 1 (the upper one in the drawing, the second cushioning material). Similarly, valley parts 7a formed on the first cushioning material 1 (the lower one in the drawing) are disposed facing mountain parts 5b formed on the second cushioning material 1 (the upper one in the drawing). By putting the faces formed with the wavy-shaped concave-convex structures on top of each other, the wavy-shaped concave-convex structures of the cushioning materials 1 are engaged with each other forming the sheet-shaped laminated structure 40 in which the linear patterns 11 are formed being aligned on a substantially same plane.

[0159]

FIG. 9A is a view showing a state in which the mountain parts 5 and the valley parts 7 of the pair of the cushioning materials 1 are disposed facing outward while the flat parts face each other, and FIG. 9B is a view showing a laminated structure 40a in which the pair of the cushioning materials 1 are laminated. That is, FIG. 9B

is a view showing the method for using the cushioning materials 1 in which the two flat faces of the cushioning materials 1 face each other. The wavy-shaped concave-convex structures of the pair of the cushioning materials 1 are disposed facing outward in opposite directions from each other and making the flat faces, which are the rear faces of the wavy-shaped concave-convex structures, contact with each other, and this contacting faces may be fixed with each other by fixing means such as hook-and-loop fasteners. At this time, the mountain parts 5a formed on the first cushioning material 1 (the lower one in the drawing) and the valley parts 7b formed on the second cushioning material 1 (the upper one in the drawing) are disposed so as to be a predetermined distance away from each other, each facing outward. Similarly, the valley parts 7a formed on the first cushioning material 1 (the lower one in the drawing) and the mountain parts 5b formed on the second cushioning material 1 (the upper one in the drawing) are disposed so as to be a predetermined distance away from each other, each facing outward.

[0160]

That is, the valley parts 7b of the second cushioning material 1 are positioned on the rear face of the mountain parts 5a of the first cushioning material 1, and the mountain parts 5b of the second cushioning material 1 are positioned on the rear face of the valley parts 7a of the first cushioning material 1. By facing and putting the flat faces on top of the other, the laminated structure 40a has faces formed with the wavy-shaped concave-convex structures of the cushioning materials 1 on both outer surface sides thereof as shown in FIG. 9B. Thus, the wavy-shaped concave-convex structures are formed substantially parallel to each other on both faces, and thus the multiple linear patterns 11 are formed side by side on the outer surfaces. This makes it possible to achieve a panel-like laminated structure that excels in design.

[0161]

FIG. 10 is a cross sectional view taken along F-F line in FIG. 8B. As shown in the drawing, an adhesive layer 17a and an adhesive layer 17b of the respective cushioning materials 1 are disposed being adjacent to each other. That is, the linear patterns 11 (the adhesive planes or the fusion planes) disposed at the mean position between the mountain parts and valley parts of the respective cushioning materials 1 forming the laminated structure 40 are disposed being adjacent to each other on the substantially same plane. Putting the surfaces formed with the wavy-shaped concave-convex structures of the cushioning materials 1 on top of the other in this way can form the linear patterns 11 side by side on the substantially same plane.

[0162]

Here, in planar view of the laminated structure 40, an apparent total occupancy rate of the adhesive layers 17a and 17b (adhesive or fusion planes) that are disposed adjacent to each other on the substantially same plane to an apparent total area of the plane including the adhesive planes is preferably 80 % or more, or more preferably 90 % or more. In this way, in the laminated structure 40 formed by facing the pair of the cushioning materials 1, the adhesive layers 17a and 17b can be disposed over a substantially entire surface of the laminated structure 40 on the same plane. Thus, when functions such as vibration control and flame-retardant functions are given to the adhesive layers 17a and 17b, substantially the entire surface of the laminated structure 40 can display these functions. Thus, a plane with functions can be formed by the adhesive or fusion planes that are disposed adjacent to each other on the substantially same plane.

[0163]

Such the laminated structure in which the cushioning materials are laminated is suitable as a partitioning material or an impact-absorbing wall panel material in shelters, for example. If the design is more important, the laminated wavy-shaped concave-convex structures are disposed as the outer surfaces, and when using any of the functions, the wavy-shaped concave-convex structures are disposed facing each other and the planes given with the functions are disposed in a substantially straight line. When the laminated wavy-shaped concave-convex structures are disposed as the outer surfaces, they may be used as they are, or a special stand may be provided. In such a case, the two cushioning materials are preferably fixed with each other by joining end side faces of the cushioning materials using hook-and-loop fasteners.

[0164]

The third embodiment can provide the similar effects as the first embodiment. Also, by joining the cushioning materials to form the laminated structure, such the laminated structure can be used as a partition and a wall panel material, etc. in disaster prevention facilities. Such the laminated structure is given with functions such as thermal insulation, cushioning, and moisture proof that conventional mats or partitioning materials made of cardboard had, and thus can provide, even in a slightest degree, cleaner and more comfortable living environment to those who suffer from disasters and are forced to live in the shelters.

[0165]

Also, by putting the wavy-shaped concave-convex structures of the resin foams

15a and 15b on top of the other so as to face each other, positions where the periodic linear patterns 11 appearing on the front face of the wavy shape can be substantially aligned. That is, these linear patterns 11 (the adhesive or fusion planes) are formed passing through the joined resin foams 15a and 15b to be arranged on a substantial plane. For example, giving sound proof or vibration control functions to the adhesive layer (or the fusion layer) forming the above linear patterns 11 can provide noise reduction and vibration control functions in addition to the design and cushioning features.

[0166]

As above, the profile-processed surface has the multiple rectangular, circular, or oval shaped adhesive or fusion planes arranged thereon. Thus, when the profile-processed planes are faced with each other, although there are some gaps existing, the adhesive or fusion planes can be disposed on the substantially same plane. For this reason, additional functions such as vibration control or noise reduction can be given to those parts. Furthermore, the resin foams 15a and 15b that interpose the adhesive or fusion planes can also have deodorant, antibacterial, or antiviral functions.

[0167]

Also, by joining the wavy-shaped concave-convex structures, a thickness of the laminated structure becomes approximately twice the thickness of the cushioning material. Thus, when being used as a partitioning material or the like, its self-standing ability in assembling can be improved. Also, when the wavy-shaped concave-convex structures are disposed as the outer surfaces, it is needless to say that there are no problems in its self-standing ability in assembling.

[0168]

(Fourth Embodiment)

Next, a fourth embodiment will be described. FIG. 11 is a plan view of a cushioning material 1c. The cushioning material 1c has substantially the same structure as the cushioning material 1 except that the cushioning material 1c includes a plurality of colors.

[0169]

As mentioned above, the front face 3 of the cushioning material 1 is divided into three sections: the mountain parts 5 formed of the resin foam 15b on the upper side of the linear patterns 11, the linear pattern formation part 13 where the linear patterns 11 are formed, and the valley parts 7 formed of the resin foam 15a on the lower side of the linear patterns 11. In the present embodiment, at least one or two

of the mountain parts 5, the linear pattern formation part 13, and the valley parts 7 are colored with different color(s) from the other part(s).

[0170]

For example, coloring the linear pattern formation part 13 with a different color from the mountain parts 5 and the valley parts 7 or coloring only the linear pattern formation part 13 can form the linear patterns 11 that are colored with the different color from the other parts. Also, coloring either the mountain parts 5 or the valley parts 7 of the wavy-shaped concave-convex structure with a different color can form three-dimensional patterns in which either the mountain parts 5 or the valley parts 7 are colored.

[0171]

For example, in a case in which the linear patterns 11 are formed by the fusion layer, the fusion layer may be colored, at the time of crystallization of a surface of a resin foam forming the fusion layer during a process of solidifying following melting, with the different color by superimposing crystallization state, the change in molecular orientation, and effects of residuals of ADCA remaining on the surface of the resin foam. Alternatively, the fusion layer may be colored by using a resin foam in which one of fusion planes of the resin foam to be fusion bonded is colored with a different color. These can also color the linear pattern formation part 13 with a different color from the mountain parts 5 and the valley parts 7.

[0172]

Also, in a case in which the linear patterns 11 are formed by the adhesive layer, the adhesive layer may be colored by adding pigment to an adhesive agent and then using the adhesive agent to form the adhesive layer. This can also color the linear pattern formation part 13 with a different color from the mountain parts 5 and the valley parts 7.

[0173]

Also, to manufacture such the cushioning material 1c, for example, the resin foams 15a and the resin foams 15b having different colors may be used. The resin foams 15a and the resin foams 15b having different colors form the laminated resin foam 39 by adhesion etc., which is then profile-processed as shown in FIG. 6A so as to make the colors of the mountain parts 5 or the valley parts 7 different from the colors of the other parts. That is, in addition to two-dimensional patterns of the linear pattern formation part 13, by coloring the mountain parts 5 and the valley parts 7 of the wavy-shaped concave-convex structure with different colors, three-dimensional patterns in which the linear pattern formation part 13, the

mountain parts 5, and the valley parts 7 are all colored with different colors can be formed.

[0174]

Also, FIG. 12A is a plan view of a cushioning material 1d, and FIG. 12B is a side view of the cushioning material 1d. The cushioning material 1d has substantially the same structure as the cushioning material 1c except that an area of the mountain part that is surrounded by the linear pattern 11 is formed smaller than that of the cushioning material 1c.

[0175]

Similarly to the cushioning material 1c, the front face 3 of the cushioning material 1d is divided into three sections: the mountain parts 5 formed of the resin foam 15b on the upper side of the linear patterns 11, the linear pattern formation part 13 where the linear patterns 11 are formed, and the valley parts 7 formed of the resin foam 15a on the lower side of the linear patterns 11. Also, in the cushioning material 1d, at least one, or two, of the mountain part 5, the valley part 7, and the linear pattern formation part 13 are colored differently from the others as in the cushioning material 1c.

[0176]

On the other hand, for the cushioning material 1d, by offsetting the slicing position for the profile processing shown in FIG. 6B upward, or making the thickness of the resin foam 15b on the upper side thicker than that of the resin foam 15a on the lower side when forming the laminated resin foam 39 with the resin foams 15a and 15b, the area of the mountain part surrounded by the linear pattern 11 can be formed smaller. Consequently, a cushioning material shown in FIG. 12B can be obtained.

[0177]

The fourth embodiment can provide the same effects as the first embodiment. Also, by coloring at least part of the mountain parts 5, the valley parts 7, and the linear patterns 11 with colors different from the others, higher design features can be obtained. In particular, changing the colors or an area ratio of the mountain parts 5 and the valley parts 7 can achieve higher design features.

[0178]

At this time, with a position of the linear pattern 11 as a boundary line, the three-dimensional design in which the mountain parts 5 and the valley parts 7 (including the bottom parts) are colored differently from the uncolored linear pattern 11 can be obtained.

[0179]

Furthermore, by offsetting the slice-processing position within a range of wavy shapes formed by the adhesive or fusion planes, the linear patterns 11 can be formed at any height within the range of the height of the wavy-shaped concave-convex structure. For example, forming the linear patterns 11 on a side of the mountain part 5 above the center of the height of the wavy-shaped concave-convex structure can form smaller patterns of the linear patterns 11 or the colored mountain parts 5. Also, forming the linear patterns 11 on a side of the valley parts 7 below the center of the height of the wavy-shaped concave-convex structure can form larger patterns of the linear patterns 11 or the colored mountain parts 5. Changing the colored areas of the mountain parts 5 and the valley parts 7 in this way can change the design features.

[0180]

(Fifth Embodiment)

(Connection Structure of Shelter Partitions using Laminated Body)

A structure of shelter partitions will be described with reference to FIG. 13 showing a shelter partition 50. The laminated body 1a is in a generally rectangular shape where a length of its longer side is twice a length of its shorter side. The shelter partition 50 includes a plurality of the laminated bodies 1a and has a floor part 52 (a mat material for disaster use) and a wall part 54 (a partitioning sidewall). The two laminated bodies 1a as mat materials for disaster use, which can also be used as a bed, are disposed on a floor as the floor part 52, where the longer sides of the substantial rectangular shape of the two laminated bodies 1a are in contact with each other to form a generally square section. Then, the laminated bodies 1a are connected and fixed to form the wall part 54, in which the laminated bodies 1a stand in directions of the shorter sides thereof with the longer sides thereof contacting the floor surface so as to surround an outer periphery of the floor part 52 formed by the disaster mats as the generally square shaped floor material. Then, the proximity of an end part of the shorter side of the rear flat face of the laminated body 1a is connected with a side end face of the shorter side at substantially right angles, and this is repeated a number of times to obtain a connection structure wherein the laminated bodies 1a are connected and fixed to each other to form the wall part 54. This connection structure includes at least a section having a sidewall formed into a generally square U shape with one open side.

[0181]

As fixing means used in forming the connection structure of shelter partitions,

loop-and-hook fasteners are used. Also, button-type fasteners or magnets that are fixed on a tape-like member may be used instead of the loop-and-hook fasteners. The fixing means is attached to a predetermined position in proximity of an end portion and on an end side face of the shorter side of the laminated body 1a. The connection structure of shelter partitions in the present invention is best characterized in that, since the fixing member is attached to the laminated body, the partitions can be formed only by facing the laminated bodies each other to be butted or fitted with each other without the need of separate fixing members. The rear face of the loop-and-hook fastener can be fixed to the laminated body using a bonding agent or an adhesive agent, and the tape-like member having the button-type fasteners or magnets can be fixed to the laminated body by attaching the tape-like member using a bonding agent or an adhesive agent.

[0182]

At this time, the end side face on the shorter side of the mat for disaster use is cut in a substantially straight line at a position a quarter pitch shifted from top parts of the mountain parts or **top parts** of the valley parts in a direction that is either substantially parallel to or perpendicular in planar view to a curve that passes through the adjacent mountain parts on the profile-processed surface. In this way, a generally rectangular cutting surface can be obtained as the cutting section of the end side face of the shorter side. By fixing the fixing means to the end side face having such a generally rectangular flat cross section, the fixing means can be fixed efficiently without the need for processing the tape-like fixing means such as the loop-and-hook fasteners. Also, in the connection structure for shelter partitions, the cushioning material may be used instead of the laminated body.

[0183]

In the connection structure for shelter partitions 50 according to the fifth embodiment, the cushioning material 1 attached with a sheet-shaped foam on its rear face may be used as the partitioning material instead of the laminated body 1a. The cushioning material 1 preferably has a height ratio (R) of 50 % or more, wherein the height ratio R is a ratio of a height (Hv) from a flat face to the valley part of the cushioning material 1 to a height (Hc) from the flat surface to the centerline between the valley part 7a and the mountain part 5a of the cushioning material 1.

[0184]

Here, from the fifth to eighth embodiments, if it is permissible to sacrifice the design, a laminated body having no linear patterns on its profile surface may be

used in place of the laminated body 1a having the multiple ring-shaped linear patterns between the mountain parts and the valley parts, and this can also provide the easy-to-assemble-and-disassemble connection structure without using any tools or special components for shelter partitions using laminated bodies, the method for assembling the shelter partition using the laminated bodies, the method for disassembling and storing the shelter partition, and the method for forming impact-absorbing wall panels for shelters.

[0185]

(Sixth Embodiment)

(Method for Assembling Shelter Partitions using Laminated Body)

Next, a sixth embodiment will be described with reference to FIG. 13 that has been used for describing the connection structure for shelter partition using the laminated bodies. FIG. 13 is a view showing the shelter partition 50. The shelter partition 50 includes a plurality of the laminated bodies 1a and has the floor part 52 (the mat material for disaster use) and the wall part 54 (the partitioning sidewall). The laminated body 1a can be obtained by laminating and adhering or fusion bonding the separate sheet-shaped resin foam on the opposite face of the face formed with the wavy-shaped concave-convex structure of the cushioning material 1. Alternatively, as mentioned above, the laminated body 1a can be obtained by using the four-layered resin foam body and slice-processing between the second and third layer thereof using a slice-processing machine. As mentioned above, a cushioning material including a plurality of layers, in which the separate sheet-shaped resin foam is further laminated and adhered or fusion bonded on the opposite face of the face formed with the wavy-shaped concave-convex structure of the cushioning material 1, is called the laminated body.

[0186]

Next, a method for assembling the shelter partition 50 shown in FIG. 13 will be described. The laminated body 1a used in this structure of the shelter partition 50 is a generally rectangular resin foam sheet having, for example, a longer side of 1800 mm, a shorter side of 880 mm, and a thickness of 30 mm (an average thickness is 25 mm). That is, the laminated body 1a is in a generally rectangular shape where the length of the longer side thereof is twice the length of the shorter side. The wavy-shaped concave-convex structure having the linear patterns is formed on one of the surface of the laminated body 1a, and a flat face is formed on the other surface thereof. A resin foam having a foaming ratio of 20 to 40 times is used for the laminated body 1a. For example, if the foaming ratio is 30 times, the laminated

body weighs approximately 1.25 kg. If the foaming ratio is 20 times, the weight is approximately 1.9 kg, which is less than 2 kg. Also, the average thickness is allowed to be up to 50 mm. However, considering storage during normal time other than at the time of disaster, it is preferable that the laminated body is as thin as possible and its thickness of 40 mm or less is sufficient. Thus, the weight of the laminated body is 5 kg or less at the maximum and does not exceed 4kg.

[0187]

First, the floor part 52 of the shelter partition 50 is formed. Placing a plurality of the laminated bodies 1a side by side with either the flat face or the concave-convex face of the laminated body 1a facing the floor surface can form the floor part 52 on the floor surface. Placing the longer sides of the two laminated bodies 1a along with each other makes the generally square-shaped floor part 52, forming the floor part 52 of approximately two-tatami mat (1.8 m by 1.8 m square room). That is, the laminated bodies 1a, which are the mat for disaster use and can be used as a bed, are disposed on the floor surface with the longer sides of the substantial rectangles being in contact with each other to form a generally square shaped section. Then, the laminated bodies 1a form the floor part 52 having cushioning features and excellent moisture proof and thermal insulation functions.

[0188]

Next, the wall part 54 for partitioning the sections is formed for the floor part 52 of the shelter partition 50. The wall part 54 is disposed surrounding the three sides of the generally square shaped region of approximately two tatami mats formed by the two laminated bodies 1a. That is, the laminated bodies 1a standing on a shorter side direction surround the outer periphery of the generally square-shaped mat for disaster use that can be used as a bed, and the end parts of the shorter sides are connected to each other at substantially right angles with the longer sides of the laminated bodies 1a as contacting faces with the mat for disaster use.

[0189]

In more details, firstly, the laminated body 1a is placed standing on the floor part 52 so that the longer side of the laminated body 1a is in contact with the generally square-shaped floor part 52. Then, the shorter sides of the three laminated bodies 1a standing on the floor part 52 are connected in turn so that the generally U-shaped wall part 54 with an opening at one side of the generally square-shaped section is formed. Using the laminated bodies 1a as the partitioning partitions can form the shelter partition 50, which is one section in the shelter

partitioned by the U-shaped a sidewall with an opening at one side of the generally square-shaped section. At this time, the end side face on the shorter side of the mat for disaster use is cut in a substantially straight line at a position a quarter pitch shifted from top parts of the mountain parts or the top parts of the valley parts in a direction that is either substantially parallel to or perpendicular in planar view to a curve that passes through the adjacent mountain parts on the profile-processed surface. In this way, a generally rectangular cut section can be obtained as the cutting section of the end side face of the shorter side. By obtaining such a shape for the end side face of the laminated body, hook-and-loop fasteners or tape-like members attached with the fixing means can be fixed efficiently to the end side face of the laminated body, and it is unnecessary to process the tape-like members to match the end side face.

[0190]

A first section has been formed from a basic one section, which is obtained as above as the square-shaped section with three sides being surrounded by the laminated bodies 1a. Next, a generally square-shaped second section will be formed adjacent to the first section. In more details, the floor part 52 of the second section is formed connecting to the floor part 52 of the first section similarly as the first section. That is, adjacent to the mat for disaster use, which can be used as a bed, as a flooring material for the first section, a generally square-shaped mat for disaster use, which can be used as a bed, as a flooring material for the second section having the similar size as the first section is formed using the laminated bodies 1a. Then, the U-shaped wall part 54 having an opening on an opposite direction to the opening of the first section is disposed to form the second section. By using the laminated bodies 1a to form the U-shaped sidewall having the opening on the opposite direction to the opening of the first section in succession to the first section formed in the U shape and sharing one end part of the U shape in this way, at least two U-shaped sections can be formed.

[0191]

Next, similarly to the first and second sections, the floor part 52 for a third section is formed adjacent to the second section, and then the U-shaped wall part 54 having the opening in the opposite direction to the opening of the second section is disposed so as to form the third section. That is, the partitioning sidewall parts are formed by forming repeatedly the U shapes with the openings of the generally square section being opened alternating in opposite directions, and then the generally square-shaped mats for disaster use as flooring material, which can be

used as beds, are formed repeatedly corresponding to the sidewalls to form multiple sections.

[0192]

Forming the generally square-shaped floor part 52 and then forming the wall part 54 by making the longer sides of the laminated bodies 1a contact with the floor part 52 can form the generally U-shaped section. At this time, the adjacent sections have the U-shaped wall parts 54 formed that are opened to the opposite directions to form partitioning partitions. Thus, the shelter partition 50 including at least two or three generally square-shaped sections can be formed.

[0193]

Furthermore, the plurality of the generally square-shaped floor parts 52 are formed so as to be adjacent to each other, and the wall parts 54 are formed repeatedly corresponding to the adjacent floor parts 52 with the openings of the wall parts 54 facing in opposite directions alternately. In this way, the shelter partition 50 in which the multiple sections are disposed in sequence can be formed.

[0194]

In this assembly method, the laminated body 1a may be disposed with the flat face thereof facing the floor surface. That is, as a floor material, the laminated body 1a may be disposed with either the flat face or the face having the wavy-shaped concave-convex structure facing the floor surface. Also, the U-shaped wall parts 54 formed by the laminated bodies 1a may be disposed with the faces alternating between the pattern-formed face having the wavy-shaped concave-convex structure and the opposite flat face. For example, for the sidewall formed by the laminated bodies 1a disposed in the U shapes, the pattern-formed faces having the wavy-shaped concave-convex structures of the laminated bodies 1a are disposed along each side of the section so as to face outward, inward, and outward in turn, or inward, outward, and inward in turn, to form the shelter partition 50. Such an arrangement can improve the design features in the shelter. Also, this enables to give the excellent sound proof, moisture proof, and thermal insulation functions at the same time. Thus, people using the shelter can spend their time comfortably inside their predetermined sections. As above, in forming the sections, the direction of the face with the wavy-shaped concave-convex structures along each side of the section should be decided appropriately considering the design.

[0195]

Also, when assembling the laminated bodies 1a into the partitioning partitions, the laminated bodies 1a may be connected to each other by using loop-and-hook

fasteners that are attached to the front face of the laminated body 1a, the loop-and-hook fastener having micro protrusions formed on its surface. By connecting the laminated bodies 1a to each other by using the loop-and-hook fasteners in this way, the shelter partition 50 can be easily assembled. Also, each laminated body 1a weighs approximately 1.5 kg and is light in weight, and thus excels in carrying movability at the time of assembly. Also, since the laminated body 1a used for the shelter partition 50 is a laminated body in which a separate sheet of resin foam is laminated on the opposite face of the wavy-shaped concave-convex structure of the cushioning material 1 having patterns on the front face thereof, the laminated body 1a excels in self-standing ability in assembling when used as the wall part 54.

[0196]

Here, “excels in self-standing ability in assembling” means that, when fixing the laminated bodies 1a to each other by using loop-and-hook fasteners, etc., for example, to form the shelter partition 50, since its balance is stable, the connected standing laminated body 1a does not slant or warp at an upper part of the shorter side thereof on a side of the other end face, which is opposite to the part fixed by the loop-and-hook fasteners, so that assembling while standing on itself is possible.

[0197]

When connecting the laminated bodies 1a, it is preferable that an end part in a width direction of the flat face of one of the laminated bodies 1a (the first laminated body) and an end face of the other laminated body 1a (the second laminated body) are in contact and connected with each other by using the loop-and-hook fasteners. For example, the loop-and-hook fasteners are attached to predetermined positions of the flat face of the laminated body 1a from an upper end part to a lower end part of a longer side direction, or to predetermined positions from an upper part to a lower part of the part corresponding to the flat part of the end face of the laminated body. In more details, these loop-and-hook fasteners are preferably attached to at least three positions in a height direction: upper, middle, and lower positions.

[0198]

For example, the first laminated body 1a has the loop-and-hook fasteners attached to predetermined positions of the upper end part, middle part, and lower end part in the width direction of the flat face of the laminated body 1a. The second laminated body 1a has the loop-and-hook fasteners attached to predetermined positions of the upper, middle, and lower parts of the end face. Here, fixing position of the fixing means such as the loop-and-hook fasteners may be arranged as above,

or may be uniformly arranged from the upper end part to the lower end part as long as the laminated bodies are stably connected and supported with each other.

[0199]

If the attached positions of the loop-and-hook fasteners on the first and second laminated bodies 1a correspond to each other, then the laminated bodies 1a can be connected with each other by facing the loop-and-hook fasteners attached to the flat face of the first laminated body 1a and the loop-and-hook fasteners attached to the end face of the second laminated body 1a. Facing each other the loop-and-hook fasteners attached on the predetermined positions of the flat face and the loop-and-hook fasteners attached to the end face connect the both. At this time, if the laminated bodies 1a exceling in self-standing ability in assembling are used, the assembled partitioning partition has no unnecessary gaps and thus excels in assembling ability.

[0200]

As the fixing means used to assemble the shelter partitions, the loop-and-hook fasteners are used here for illustration. However, button-type fasteners or magnets that are fixed on a tape-like member may be used instead of the loop-and-hook fasteners. The same effects can also be obtained as in the connection structure of the shelter partitions. The rear face of the loop-and-hook fastener can be fixed to the laminated body using a bonding agent or an adhesive agent, and the tape-like member having the button-type fastener or magnet can be fixed to the laminated body by attaching the tape-like member using a bonding agent or an adhesive agent.

[0201]

Although details will be described below, the laminated body 1a having excellent self-standing ability in assembling preferably has the height ratio of 50 % or more, or more preferably, 60 % or more, wherein the height ratio is a ratio of the height (Hv) from the flat face to the valley part 7a of the laminated body 1a to the height (Hc) from the flat face to the centerline between the valley part 7a and the mountain part 5a of the laminated body 1a.

[0202]

In the method for assembling the shelter partition 50, instead of using the laminated body 1a as the partitioning partition material, the cushioning material 1 having the wavy-shaped concave-convex structure with the linear patterns on the front face thereof may be used. To make the cushioning material 1 excel in self-standing ability in assembling, it is also similarly preferable that the height

ratio, which is the ratio of the height (H_v) from the flat face to the valley part 7a of the cushioning material 1 to the height (H_c) from the flat face to the centerline between the valley part 7a and the mountain part 5a of the cushioning material 1, is 50 % or more.

[0203]

(Relation between the cutting position and cutting shape of the end part side face of the laminated body)

The cutting sections to which the fixing means for the laminated bodies 1a are attached in the fifth to seventh embodiments will be examined here. FIG. 14A to FIG. 14C show the relation between the cutting positions and the shape of the cutting section of the end side face of the laminated body. FIG. 14A shows the cutting positions viewed from the profile-processed surface of the laminated body. FIG. 14B shows the cut section (a cut section 71 connecting top parts of the mountain parts) when the laminated body is cut along a curve passing through the top parts of the mountain parts and the bottom parts of the valley parts alternately. FIG. 14C shows the cut section (a cut section 70 connecting inflection points) when the laminated body is cut in a straight line connecting positions of inflection points that are quarter pitch away from the top parts of the mountain parts and the bottom parts of the valley parts.

[0204]

When the laminated body 1a is cut in a substantially straight line along X-X line in FIG. 14A on the curve passing through the top parts of the mountain parts and the bottom parts of the valley parts alternately, the maximum concave-convex shape of the cut section and the minimum parallel cut section area of the end face of the laminated body can be obtained. Whereas, when the laminated body 1a is cut in a substantially straight line connecting positions of inflection points that are quarter pitch away in a substantially parallel or perpendicular direction in planar view from the top parts of the mountain parts and the bottom parts of the valley parts, the minimum concave-convex shape of the generally rectangular cut section and the maximum parallel cut section area of the end face of the laminated body can be obtained. For example, when the laminated body 1a is cut along Y-Y line in FIG. 14A, the minimum concave-convex shape of the generally rectangular cut section and the maximum parallel cut section area of the end face of the laminated body as shown in FIG. 14C can be obtained. At this time, if the adhesive layer or the fusion layer that is a boundary between the resin foam 15a and the resin foam 15b forming the mountain and valley parts coincides with the inflection points of the curves from

the top part of the mountain parts to the bottom parts of the valley parts of the profile-processed surface, the periodic linear patterns having predetermined lengths are formed on an upper end part of the substantially parallel cut section. If the linear patterns are formed at positions shifted either upward or downward from the inflection points, the linear patterns do not appear on the cut section. Here, in a case in which the line connecting the top part of the mountain part and the bottom part of the valley part is not curved but straight in shape, by cutting in a substantially straight line connecting the mean positions between the top parts of the mountain parts and the bottom parts of the valley parts, or the mean positions between the bottom parts of the valley parts and the top parts of the mountain parts, the generally rectangular cut section similar to the case where there are inflection points can be obtained and the similar behavior is confirmed.

[0205]

Also, since the mountain and valley parts on this profile-processed surface have the same periodic structure in directions crossing perpendicularly to each other, it is possible to cut the laminated body 1a in a substantially straight line connecting positions of inflection points of the middle from the top parts of the mountain parts to the bottom parts of the valley parts, or the middle from the bottom parts of the valley parts to the top parts of the mountain parts in a substantially parallel or perpendicular direction in planar view. Here, to be exact, considering the periodic structure of the mountain and valley parts, it can be understood from FIG. 4A showing the cutting positions that such the positions of inflection points appear periodically at positions that is quarter, three quarters, and five quarters pitches when the distance between the two adjacent top parts of the mountain parts, or between the two adjacent bottom parts of valley parts, on the profile-processed surface is considered as one pitch. To be more exact, it is possible to cut at every $(2N+1)/4$ pitch, where N is a natural number. It is also possible to cut in the same direction between X-X line in FIG. 14A and Y-Y line in FIG. 14B. In such a case, it is possible to obtain a cut section having concave-convex shapes that are smaller than those obtained when being cut at X-X line in FIG. 14A. In this case, if the cutting position is closer to X-X line, dimensions of the concave-convex shapes are closer to those when being cut at X-X line, and if the cutting position is closer to Y-Y line, the dimensions of the concave-convex shapes is closer to those when being cut at Y-Y line, which is almost flat. Cutting in this way is also possible if necessary.

[0206]

Depending on the cutting positions, the laminated body has a different area of

the flat part to which the fixing means is attached. So, if a cut section having the largest parallel part area on the side end face is chosen to be a cutting part, then the area to which the fixing means such as loop-and-hook fasteners are attached can be maximized. By cutting at a position that is quarter pitch shifted from the line connecting the top parts of the mountain parts and the bottom parts of the valley parts, and the bottom parts of the valley parts and the top parts of the mountain parts, that is connecting the inflection points of the curve connecting the mountain parts and the valley parts, the side end face can be formed into a generally rectangular shape having the parallel area as large as possible with less narrow parts of the periodic concave-convex structure of the width of the side end face. This can maximize a width of the tape-like member that is a fixing means to be attached to the side end face, and thus the firm and strong connection structure can be obtained.

[0207]

(Seventh Embodiment)

(Method for Disassembling and Storing Shelter Partition)

Next, a method for disassembling and storing the shelter partition will be described. FIG. 15A and FIG. 15B are view showing storing states of the shelter partition 50 that has been assembled by the above-mentioned method, wherein FIG. 15A is a front view and FIG. 15B is a plan view. When storing, the shelter partition 50 is stored on the wall surface 51 with the end faces of the laminated bodies 1a being fixed.

[0208]

To disassemble and store the shelter partition, the shelter partition 50 including the laminated bodies 1a is disassembled first. After disassembling, one of the laminated bodies 1a is disposed facing its flat face the wall surface 51 and fixed to the wall surface 51. Although there are other means, a case in which loop-and-hook fasteners 53 are used as the fixing means for fixing will be described here. Loop-and-hook fasteners 53d are disposed at predetermined positions on both sides of the flat face of the laminated body 1a, and loop-and-hook fasteners 53c are disposed on the wall surface 51 at positions corresponding to the positions where the loop-and-hook fasteners 53d are arranged. Thus, the loop-and-hook fasteners 53c and 53d can fix the laminated body 1a to the wall surface 51. That is, by contacting the loop-and-hook fasteners 53d on the wall surface 51 with the loop-and-hook fasteners 53d on the first laminated body 1a, the laminated body 1a can be fixed to the wall surface 51 standing.

[0209]

Then, the face with the wavy-shaped concave-convex structure of the second laminated body 1a is placed onto the rear face of the flat face of the standing and fixed first laminated body 1a, which has the wavy-shaped concave-convex structure, and the end face of the first laminated body 1a is aligned to make a pile of two layers. After that, the flat face and the face with the wavy-shaped concave-convex structure, which are the stacking surfaces respectively, of the third and fourth new laminated bodies 1a are placed standing in turn in the same way as in the case of the first and second laminated bodies, aligning the stacking surfaces and the end faces. That is, the laminated bodies 1a are repeatedly placed standing facing the flat faces each other or facing the faces with the wavy-shaped concave-convex structure each other in turn and aligning the end faces.

[0210]

After that, the laminated bodies 1a are further placed over in the same procedure. If the number of the stacked laminated bodies 1a is an odd number, the last stacking surface is the flat face and the outermost surface has the wavy-shaped concave-convex structure. If the number of the stacked laminated bodies 1a is an even number, the last stacking surface is the face having the wavy-shaped concave-convex structure and the outermost surface is the flat face. The laminated bodies are repeatedly stacked in turn and placed standing.

[0211]

Here, the loop-and-hook fasteners 53c are attached to the predetermined positions of the end face of the laminated bodies 1a. Thus, another loop-and-hook fastener 53b having a length that matches an entire thickness of the stacked laminated bodies 1a is disposed across the loop-and-hook fasteners 53a on the end faces of the respective laminated bodies 1a that are placed standing so that all the end faces of the laminated bodies 1a can be fixed at once.

[0212]

Although the loop-and-hook fasteners are used for illustration here as the fixing means used to disassemble and store the shelter partitions, button-type fasteners or magnets that are fixed on tape-like members may be used instead of the loop-and-hook fasteners. Also in the method for disassembling and storing the shelter partition, using the button-type fasteners or magnets fixed on tape-like members as fixing means facilitates disassembling and storing of the shelter partitions. The rear face of the loop-and-hook fastener can be fixed to the laminated body using a bonding agent or an adhesive agent, and the tape-like member having

the button-type fastener or magnet can be fixed to the laminated body by attaching the tape-like member using a bonding agent or an adhesive agent. At this time, needless to say, the fixing means used in the method for disassembling and storing shelter partitions are the same as the fixing means used for assembling the laminated bodies used for assembling the shelter partition.

[0213]

As above, the laminated bodies 1a used for the shelter partition 50 can be disassembled and stored. At this time, the laminated bodies 1a can be stored compactly with the face of the laminated body 1a having the linear patterns of the wavy-shaped concave-convex structure being disposed as the outermost surface. At this time, since the end face of the laminated body 1a is used in assembling the shelter partition 50, the end face of the laminated body 1a that is to be fixed at the time of assembling is cut, as mentioned above, in a substantially straight line at a position a quarter pitch shifted from the top parts of the mountain parts or the valley parts in the direction that is either substantially parallel to or perpendicular in planar view to the curve that passes through the adjacent mountain parts on the profile-processed surface. In this way, the generally rectangular cutting section can be obtained as the cutting section of the end side face of the shorter side. By obtaining such a shape for the end side face of the laminated body, loop-and-hook fasteners or tape-like members attached with the fixing means can be fixed efficiently to the end side face of the laminated body, and it is unnecessary to process the tape-like members to match the end side face.

[0214]

In the method for disassembling and storing the shelter partition 50 mentioned above, instead of using the laminated body 1a, the cushioning material 1 having the wavy-shaped concave-convex structure with the linear patterns on the front face thereof may also be used.

[0215]

(Eighth Embodiment)

(Method for forming Impact-Absorbing Wall Panel for Shelter Partition)

FIG. 16A and FIG. 16B are view showing an impact-absorbing wall panel 60 for the shelter partition, wherein FIG. 16A is a front view, FIG. 16B is a plan view, and FIG. 16C is an enlarged view of proximity of the loop-and-hook fasteners 53c and 53d in FIG. 16B. The method for forming the impact-absorbing wall panel 60 is as follows. Firstly, as mentioned above, the shelter partition 50 assembled by the method for assembling the shelter partition using the laminated bodies 1a is

disassembled. Here, similar to the above case, the loop-and-hook fasteners will be used as the fixing means for illustration.

[0216]

Next, the disassembled laminated body 1a is disposed with the flat face thereof facing the wall surface 51. At this time, the loop-and-hook fasteners 53d are disposed at the predetermined positions on both sides of the flat face of the laminated body 1a, and the loop-and-hook fasteners 53c are disposed at the predetermined positions of the wall surface 51 corresponding to the positions where the loop-and-hook fasteners 53d are arranged. That is, the loop-and-hook fasteners 53c are arranged at the predetermined positions of the wall surface 51 corresponding to the positions where the loop-and-hook fasteners 53d are arranged on the flat faces of the laminated bodies 1a when the shorter sides of the laminated bodies 1a are disposed in sequence as the standing faces parallel to the wall surface 51. In this way, the loop-and-hook fasteners 53c and 53d can fix the laminated bodies 1a to the wall surface 51 with the concave-convex faces thereof facing interior of the room.

[0217]

The other laminated body 1a is further disposed, with the flat face thereof facing the wall surface 51 and the wavy-shaped concave-convex structure face facing the interior of the room, in succession to the first fixed laminated body 1a, and fixed to the wall surface 51 by the loop-and-hook fasteners 53c arranged on the predetermined positions of the wall surface 51. Fixing further the laminated body 1a to the wall surface 51 in succession to the laminated body 1a that has been fixed immediately ahead repeatedly can form the impact-absorbing wall panel 60 for the shelter partition. As above, in the present embodiment, when not used as the floor part 52, the wall part 54, or partitions for the shelter partition 50, the laminated bodies 1a are fixed to the wall surface 51 with the concave-convex faces thereof facing the interior of the room, so that the laminated bodies 1a can form on the wall surface 51 the impact-absorbing wall panel 60 having a predetermined dimensions and excellent design.

[0218]

Also, instead of using the laminated body 1a, the cushioning material 1 having the wavy-shaped concave-convex structure with the linear patterns on the front face thereof may also be used. In such the case, the impact-absorbing wall panel 60 can also be formed after disassembling the shelter partition 50 including the cushioning materials 1. As above, the laminated body 1a can be used as a mat material for

disaster use at the time of the disaster, which can be used as a sidewall of the shelter partition or as a bed, and, during the normal time, the laminated body 1a can be used as the impact-absorbing wall panel material.

[0219]

Although the loop-and-hook fasteners are used for illustration here as the fixing means used in the method for forming the impact-absorbing wall panel for the shelter partition, button-type fasteners or magnets that are fixed on tape-like members may be used instead of the loop-and-hook fasteners. The same fixing means can be used also in the method for forming the impact-absorbing wall panel for the shelter partition. The rear face of the loop-and-hook fastener can be fixed to the laminated body using a bonding agent or an adhesive agent, and the tape-like member having the button-type fastener or magnet can be fixed to the laminated body by attaching the tape-like member using a bonding agent or an adhesive agent. At this time, needless to say, the fixing means used in the method for forming the impact-absorbing wall panel for the shelter partition are the same as the fixing means used for assembling the laminated bodies used for assembling the shelter partition.

[Working Examples]

[0220]

(Evaluation by Evaluation Test for Self-standing Ability in Assembling of Laminated Body)

Since the partitioning sidewall (the wall part 54) including the plurality of the laminated bodies 1a joined by the loop-and-hook fasteners needs cushioning features, the laminated body 1a used here does not necessarily have high rigidity. Thus, tests to confirm the self-standing ability of the sidewall for partitions at the time of assembling operations have been performed. FIG. 17 is a view illustrating the self-standing ability in assembling test of the partitions, and FIG. 18A is a view showing measurements of each part of the laminated body 1a used for the evaluation of self-standing ability in assembling of the partitions.

[0221]

For the evaluation of self-standing at the time of assembling, two laminated bodies 1a' and 1a'', each having a length of 1800 mm in the longer side direction (I in the drawing) and 880 mm in a height direction (J in the drawing: the shorter side direction), are prepared modeling the partitioning sidewall. The two laminated bodies 1a' and 1a'' are disposed so that the cut two laminated bodies 1a' and 1a'' are laid down on its length direction parts contacting the floor surface and meeting at

right angles.

[0222]

As shown in FIG. 17, the end part in the length direction of the flat face of the first laminated body 1a' and the side end face in the length direction of the second laminated body 1a'' are connected with each other by using the loop-and-hook fasteners. The laminated bodies 1a' and 1a'' are connected at three connecting positions in the height direction: an upper loop-and-hook fastener attaching part 61a, a middle loop-and-hook fastener attaching part 61b, and a lower loop-and-hook fastener attaching part 61c. That is, for the first laminated body 1a', the loop-and-hook fasteners are attached in the height direction at an upper part, a middle part, and a lower part of the end part of the length direction of the flat face of the laminated body 1a'. Also, for the second laminated body 1a'', the loop-and-hook fasteners are attached to the predetermined positions in the height direction at an upper part, a middle part, and a lower part of the side end face of the length direction of the laminated body 1a''.

[0223]

By facing and connecting the loop-and-hook fasteners attached to the flat face of the first laminated body 1a' and the loop-and-hook fasteners attached to the side end face of the second laminated body 1a'' with each other can form a connection structure in which the laminated bodies are connected being met at right angles to each other. This connection structure of the laminated bodies is used to evaluate the self-standing ability in assembling. The laminated body used here is cut in a straight line at a position a quarter pitch shifted in a direction that is substantially parallel in planar view from the position where the concave-convex shapes are the largest, which is a curve that passes through the mountain parts on the profile-processed surface of the laminated body. Thus, the side end face of the laminated body can be cut into a substantially parallel cutting section having a thickness that is equivalent to the sheet thickness before profile processing. Here, an average thickness of the laminated body used in the working examples is 20 - 30 mm. The laminated body used in the working examples is cut to have the substantially parallel cutting section having a thickness that is equivalent to the average thickness of the laminated body, and thus a loop-and-hook fastener of 150 mm by 20 mm can be attached to the end face of the laminated body without any problems and supporting force of the loop-and-hook fastener can be efficiently utilized.

[0224]

The laminated body 1a used in the test is formed by slice processing, using a profile-processing device, a polyethylene foam sheet having a foaming ratio of 40 times. At this time, to evaluate influence of the size and shapes of the wavy-shaped concave-convex structure on the front face of the laminated body on the self-standing ability in assembling, laminated bodies having various size and shapes with different ratio of heights of the flat face and the mountain and valley parts of the wavy-shaped concave-convex structure part in the thickness direction of the laminated body to the entire thickness are prepared. The laminated bodies obtained as above, having the wavy-shaped concave-convex structure, the periodic linear patterns on the front faces, and sheet-shaped resin foams laminated onto the rear faces, are used as the test pieces to evaluate the self-standing ability in assembling. The results of the evaluation for the self-standing ability in assembling are shown in Table 1 and Table 2.

[0225]

[Table 1]

Test Piece	Test Piece 1	Test Piece 2	Test Piece 3	Test Piece 4	Test Piece 5	Test Piece 6	Test Piece 7	Test Piece 8
Average Thickness of Laminated Body (mm)	26	27	28	29	30	30	30	30
Wavy-shaped Processed Height (Half-Value Width of Concave-Convex Structure)	14	13	12	11	16	12	8	6
Height from Flat Face to Mountain Part Hm (mm)	40	40	40	40	46	42	38	36
Height from Flat Face to Valley Part Hv (mm)	12	14	16	18	14	18	22	24
Height from Flat Face to Centerline of Wavy Shapes Hc:(mm)	26	27	28	29	30	30	30	30
$R=(H_v/H_c) \times 100$ (%)	46	51	57	62	46	60	73	80
Self-standing ability in assembling Evaluation	not enough	good	good	excellent	not enough	excellent	excellent	excellent

[0226]

[Table 2]

Test Piece	Test Piece 9	Test Piece 10	Test Piece 11	Test Piece 12	Test Piece 13	Test Piece 14	Test Piece 15
Average Thickness of Laminated Body (mm)	25	25	25	20	20	20	20
Wavy-shaped Processed Height (Half-Value Width of Concave-Convex Structure)	10	7	4	11	9	7	4
Height from Flat Face to Mountain Part Hm (mm)	35	32	29	31	29	27	24
Height from Flat Face to Valley Part Hv (mm)	15	18	21	9	11	13	16
Height from Flat Face to Centerline of Wavy Shapes Hc:(mm)	25	25	25	20	20	20	20
$R=(H_v/H_c) \times 100$ (%)	60	72	84	45	55	65	80
Self-standing ability in assembling Evaluation	excellent	excellent	excellent	not enough	good	excellent	excellent

[0227]

In Table 1 and Table 2, the height from the flat face to the mountain part (H_m) is equivalent to the sheet thickness (the maximum thickness) of the laminated body as shown in FIG. 18A. The height from the flat face to the mountain part (H_m) is equivalent to the sum of the thickness of the sheet-shaped foam and the height of the mountain part of the cushioning material. Also, the height from the flat face to the valley part (H_v) is equivalent to a thickness of the laminated body at the bottom part of the valley part 7a (the minimum thickness) as shown in FIG. 18B. The height from the flat face to the valley part (H_v) is equivalent to the sum of the thickness of the sheet-shaped foam and the height of the valley part of the cushioning material. Also, the height from the flat face to the centerline of the wavy-shaped concave-convex structure of the laminated body (H_c) is a distance from the flat face of the rear surface of the laminated body to a centerline K between the top part of the mountain part 5 and the bottom part of the valley part 7a as shown in FIG. 18A. That is, H_c can be calculated as follows:

$$H_c = H_v + (H_m - H_v) / 2 = (H_m + H_v) / 2$$

Also, a “wavy-shaped processed height (a half-value width of the concave-convex structure)” in Table 1 and Table 2 is equivalent to $(H_m - H_v) / 2$.

[0228]

Also, in Table 1 and Table 2, “evaluation for self-standing ability in assembling” is “good” for the connection structure of the laminated bodies shown in FIG. 17 if the laminated body of the connection structure on the side opposite to the part fixed by the loop-and-hook fasteners does not warp or bend at an upper end of the end part in the width direction, and is “not enough” if there is a slight warp or bending of even 2 or 3 mm occurred at the upper end. That is, the laminated body with no warp or bending at the end face opposite to the loop-and-hook fastener connecting part is evaluated as having the excellent self-standing ability in assembling. Thus, by using such the laminated bodies having the excellent self-standing ability in assembling, it is possible to prevent the assembled partitioning partition from having unnecessary gaps, so that the assembling ability is excellent.

[0229]

As can be seen from Table 1 and Table 2, relationships between the self-standing ability in assembling and R are evaluated for the following test pieces, wherein R is a ratio in percentage of the height from the flat rear face to the

centerline of the wavy-shaped concave-convex structure face (H_c) to the height from the rear flat face to the valley part of the laminated body (H_v). In Table 1 and Table 2, test pieces 1 to 4 have a constant mountain part height of the laminated body of 40 mm and various wavy-shaped processed heights so as to change the R value from 44% to 62%. Test pieces 5 to 8, 9 to 11, and 12 to 15 are working examples having constant average thicknesses of the laminated bodies of 30 mm, 25 mm, and 20 mm, respectively, and various wavy-shaped processed heights (the half-value width of the concave-convex structure). Here, as mentioned above, those with even very slight deformation are evaluated as “not enough”, those having no problems in self-standing ability in assembling are evaluated as “good”, and those that can prevent deterioration of self-standing ability in assembling even after long storing time are evaluated as “excellent”.

[0230]

Among the above test pieces 1 to 15 of laminated bodies having the average heights within a range between 20 mm and 30mm and various wavy-shaped processed heights, the test pieces 1, 5, and 12 whose R is 50 % or less generate very slight warp and bending; whereas if R is 50 % or more, it has been confirmed that warp or bending does not occur and the laminated bodies with excellent self-standing ability in assembling can be obtained. Also, since foam bodies are stored for a long time when used in the shelters, it is preferable that R is 60 % or more, considering that the self-standing ability in assembling may deteriorate due to slight ageing deterioration in rigidity during the storing. As fixing means used for evaluating the self-standing ability in assembling, instead of the loop-and-hook fasteners, the button-type fasteners or magnets fixed on tape-like members may be attached to the laminated bodies. The same evaluation was carried out using the button-type fasteners or magnets as the fixing means, and the similar results were obtained.

[0231]

A reason for this can be considered as below. A cross-sectional area of the mountain part region above the centerline K is equal to a cross-sectional area of the valley part region below the centerline K. Here, an imaginary sheet-shaped foam is considered, in which the mountain parts 5a are shifted to the sides of the valley parts 7a and turned over so that the thickness of the foam is equivalent to H_c , which is the height from the rear flat face of the laminated body to the centerline of the wavy-shaped concave-convex structure face (see FIG. 18B and FIG. 18C). In this case, since volume of the mountain part 5a is equivalent to volume of the valley part

7a, the center of gravity of the laminated body (L in FIG. 18C) is substantially equal to the centerline of the imaginary sheet-shaped foam. This can be easily understood from the fact that the two foam bodies obtained from slicing the sheet-shaped foam body at the center of the sheet thickness by profile processing have the same weight. If a condition that the above R is 50 % or more can be satisfied, the center of gravity is to be located on the side of the flat face than the valley part 7a on the end face of the laminated body, which stabilizes the laminated body. Here, more preferably, the foam can be more stabilized if the condition satisfies 60 % or more.

[0232]

As can be seen from the above results of the evaluation test of the self-standing ability in assembling of polyethylene foam sheets having the foaming ratio of 40 times, the self-standing ability in assembling may be more advantageous than this material if harder material or a material having the foaming ratio of less than 40 times is used. Thus, if the resin foam having the foaming ratio of 40 times or less is used and the laminated body satisfies the value of R, which is a ratio of the height (Hv) from the flat face of the sheet-shaped form on the rear face of the laminated body to the valley part of the laminated body to the height (Hc) from the flat face of the sheet-shaped form on the rear face of the laminated body to the centerline of the wavy-shaped concave-convex structure face, to be 50 % or more, there is no problem in the self-standing ability in assembling. Also, this laminated body is light in weight, and thus partitioning partitions having excellent design can be easily assembled.

[0233]

Here, for the laminated body 1a in which another sheet-shaped foam is attached to the rear face side of the cushioning material 1 having the wavy-shaped concave-convex structure on its front face, a resin foam that is harder than the cushioning material 1 may be used as the sheet-shaped foam provided onto the rear face. In this case, the center of gravity of the laminated body is also shifted slightly toward a side of the hard sheet-shaped foam, and thus the self-standing ability in assembling is further improved. Thus, more stable condition can be obtained when at least the same relationship as in the case in which the laminated body is made of materials of the same nature is satisfied.

[0234]

Instead of the laminated body 1a, the cushioning material 1 may also be used. In this case, if the cushioning material 1 that satisfies the value of R, which is a ratio of a height (Hv) from the flat face to the valley part to the height (Hc) from the

flat rear face of the cushioning material 1 to the centerline of the wavy-shaped concave-convex structure face, to be 50 % or more, is used, the similar self-standing ability in assembling as the laminated body 1a can be obtained even if the cushioning material has no sheet-shaped foam provided on its rear face.

[0235]

Although the embodiments of the present invention have been described referring to the attached drawings, the technical scope of the present invention is not limited to the embodiments described above. It is obvious that persons skilled in the art can think out various examples of changes or modifications within the scope of the technical idea disclosed in the claims, and it will be understood that they naturally belong to the technical scope of the present invention. For example, needless to say, the above-mentioned embodiments can be combined with each other.

DESCRIPTION OF NOTATIONS

[0236]

1, 1c, 1d cushioning material
 3 front face
 5, 5a, 5b mountain part
 7, 7a, 7b valley part
 9 rear face
 11 linear pattern
 13 linear pattern formation part
 15a, 15b, 15c, 15d resin foam
 17, 17a, 17b adhesive layer
 20 resin-foam manufacturing device
 21 extruding machine
 23 roll-forming machine
 25 heating furnace
 27 winding-up machine
 31a, 31b roll
 33 convex portion
 35 concave portion
 37 cutting blade
 39 laminated resin foam
 1a, 1b, 1a', 1a'' laminated body

- 40, 40a laminated structure
- 50 shelter partition
- 51 wall surface
- 52 floor part
- 53a, 53b, 53c, 53d hook-and-loop fastener
- 54 wall part
- 60 impact-absorbing wall panel
- 61a, 61b, 61c loop-and-hook fastener attaching part
- 70 cut section connecting inflection points
- 71 cut section connecting top parts of mountain parts

WHAT IS CLAIMED IS:

1. A cushioning material comprising:
 - a polyolefin resin foam forming mountain parts;
 - a polyolefin resin foam forming valley parts, the polyolefin resin foam forming the mountain parts being laminated on the polyolefin resin foam forming the valley parts; and
 - an adhesive layer or a fusion layer formed between lamination planes of the polyolefin resin foam forming the mountain parts and the polyolefin resin foam forming the valley parts, wherein
 - the cushioning material has a profile-processed first face and a flat second face, the first face having a wavy-shaped concave-convex structure in which the mountain parts and the valley parts are alternately and periodically disposed in horizontal and vertical directions; and
 - the adhesive layer or the fusion layer formed substantially parallel to the second face is exposed to a part that is at a predetermined height of the wavy-shaped concave-convex structure of a front face, forming multiple ring-shaped linear patterns that are predetermined intervals apart from each other, and the linear pattern separating the mountain part and the valley part of the wavy-shaped concave-convex structure and being formed in a ring shape at the predetermined height between the mountain part and the valley part so as to surround each of the mountain parts.
2. The cushioning material according to claim 1, wherein
 - the fusion layer or the adhesive layer forms the linear patterns;
 - in a case in which the linear patterns are formed by the fusion layer, the linear patterns are formed by using a resin foam in which at least one of fusion planes of the resin foam that is to be fusion bonded is colored with a different color; or
 - in a case in which the linear patterns are formed by the adhesive layer, the adhesive layer is formed by using a colored adhesive agent.
3. The cushioning material according to claim 2, wherein
 - the fusion layer or the adhesive layer is a fusion layer, and the fusion layer is colored selectively, at the time of crystallization of a surface of a resin foam forming the fusion layer during a process of solidifying following melting, with a different color by superimposing crystallization state, change in molecular orientation, and effects of residuals of ADCA remaining on the surface of the resin foam.

4. The cushioning material according to either claim 2 or 3, wherein
the first face of the cushioning material is divided into three sections: the mountain parts formed of the resin foam on an upper side of the linear patterns, a linear pattern formation part where the linear patterns are formed, and the valley parts formed of the resin foam on a lower side of the linear patterns, wherein the adjacent valley parts are joined to each other to be integrated, and three-dimensional patterns are formed by coloring either the mountain parts or the valley parts with a color different from the linear pattern formation part.
5. The cushioning material according to claim 4, wherein
in addition to two-dimensional patterns of the linear pattern formation part, by coloring both the mountain parts and the valley parts of the wavy-shaped concave-convex structure with different colors, three-dimensional patterns in which the linear pattern formation part, the mountain parts, and the valley parts are all colored with different colors are formed.
6. The cushioning material according to any one of claims 1 to 5, wherein
the linear pattern can be formed at any height within a range of a height of the wavy-shaped concave-convex structure, and forming the linear pattern on a side of the mountain parts above the center of the height of the wavy-shaped concave-convex structure can form the smaller linear patterns or colored patterns in the mountain parts, or forming the linear patterns on a side of the valley parts below the center of the height of the wavy-shaped concave-convex structure can form the larger linear patterns or colored patterns in the mountain parts.
7. The cushioning material according to any one of claims 1 to 6, wherein
raw material for the resin foam is at least any one selected from a group consisting of polyethylene, low-density polyethylene, high-density polyethylene, ethylene-vinyl acetate copolymer, and polypropylene resin, a mixture of two or more of polyethylene, low-density polyethylene, high-density polyethylene, ethylene-vinyl acetate copolymer, and polypropylene resin, or, when total of the raw material is 100 pts.mass, resin containing 0.5 pts.mass or more and 10 pts.mass or less of polyethylene resin or polypropylene resin further including carboxyl group or functional group having an acid anhydride structure.
8. The cushioning material according to any one of claims 1 to 7, wherein
the resin foam is a polyethylene resin foam and the polyethylene resin foam has a closed-cell structure whose foaming ratio is between 20 and 40 times, and, furthermore, a permanent compression set according to JIS K6767 of the polyethylene resin foam is between 3.0 % and 7. 4%, and a compression stress of

the polyethylene resin foam at a test temperature of 25 °C at the time of 25 % compression is between 34 kPa and 56 kPa.

9. The cushioning material according to any one of claims 1, 2, 4, 5, 6, 7, and 8, wherein
 - the wavy-shaped concave-convex structure includes the adhesive layer of the cushioning material given with functionality.
10. The cushioning material according to claim 9, wherein
 - the adhesive layer formed of an adhesive agent is formed between the lamination planes of the resin foams; and
 - the adhesive layer can be given with a vibration control function by using the adhesive agent including at least one of flexible resin selected from a group consisting of urethane resin, vinyl acetate emulsion, acrylic resin, silicone resin, and modified silicone resin as a main component, or can be given with flame-retardant and vibration control functions by using the adhesive agent including acrylate ester copolymer, halogenated phosphate ester, and inorganic flame retardant as essential components.
11. The cushioning material according to any one of claims 1 to 10, wherein
 - the resin foam includes, in a range between 0.5 pts.mass and 10 pts.mass within 100 pts.mass of the resin component, any of silica, zirconium phosphate, zeolite, zinc sulfate, or zirconium sulfate as a deodorant, or amorphous calcium phosphate particles adsorbing silver ions, anatase-type titanium oxide crystal particles having photocatalytic effect, antibacterial metallic compound particles of silver, copper or zinc, or metal fine particles of silver, copper, or zinc as an antibacterial agent or an antiviral agent.
12. A laminated body comprising:
 - the cushioning material according to any of claims 1 to 11; and
 - a sheet-shaped resin foam, wherein
 - the separate sheet-shaped resin foam made of polyolefin resin is further laminated by adhering or fusion bonding onto the flat rear face of the cushioning material, which is the other face of the surface formed with the wavy-shaped concave-convex structure.
13. The laminated body according to claim 12, wherein
 - the sheet-shaped resin foam of the laminated body has a harder strength than or equivalent strength to that of the resin foam with the wavy-shaped concave-convex structure.
14. The laminated body according to either claim 12 or 13, wherein

both the resin foams, the cushioning material and the sheet-shaped resin foam, forming the laminated body are polyethylene resin foams of closed-cell structure whose foaming ratios are between 20 and 40 times, and can be used as a partitioning sidewall in shelters or mat material for disaster use that can be used as a bed, which can also be used as impact-absorbing wall panel material during normal times.

15. The laminated body according to any one of claims 12 to 14, wherein the laminated body satisfies 50 % or more of a height ratio R and thus excels in self-standing ability in assembling, wherein the height ratio R is a ratio of a height H_v , which is a height from the flat face of the sheet-shaped resin foam on the rear face of the laminated body to the valley part of the laminated body, to a height H_c , which is a height from the flat face of the sheet-shaped resin foam on the rear face of the laminated body to a centerline of the wavy-shaped concave-convex structure.
16. A method for manufacturing the cushioning material, the method comprising: cutting by slice-processing the sheet-shaped resin foams having predetermined thicknesses, facing each other, and interposing the colored adhesive layer or fusion layer immediately after passing through profile rolls at a position including the adhesive layer or the fusion layer in a horizontal direction, which is perpendicular to a thickness direction of the resin foams, before pressing force applied by upper and lower rolls is not completely elastically restored, so that the resin foams are cut as if being cut across the curved adhesive layer or the fusion layer while the adhesive layer or the fusion layer is in a curved state, which is then followed by elastic restoration of the cut and separated resin foams; and forming the adhesive layer or the fusion layer into a predetermined size and shape as a flat face running through the profile-processed surface so that periodic linear patterns are formed, as an exposed part on the flat face, at a part at a predetermined height between the mountain parts and the valley parts of the wavy-shaped concave-convex structure face of the resin foams.
17. The method for manufacturing the cushioning material according to claim 16, wherein coloring at least one of the sheet-shaped resin foams having predetermined thicknesses facing each other interposing the adhesive layer or the fusion layer, or coloring both the resin foams with different colors, forms three-dimensional patterns in which a side of the mountain part is colored differently from a side of

the valley part of the wavy-shaped concave-convex structure with the adhesive layer or the fusion layer as a boundary surface.

18. The method for manufacturing the cushioning material according to claim 17, wherein

within a width range of curves of the adhesive layer or the fusion layer of the resin foams formed by the rolls, by shifting a forming position of the adhesive layer or the fusion layer of the resin foams or by changing a height at which the slicing process is performed at an exit side of the rolls, forming positions of the mountain parts and the valley parts of the wavy-shaped concave-convex structure are adjusted, and thus sizes of the linear patterns are adjusted, so that a pair of the cushioning materials having the linear patterns of different sizes can be obtained.

19. A method for manufacturing a laminated body, the method comprising:

using a four-layered laminated resin foam including two sheet-shaped resin foams, which have predetermined thicknesses, face each other, and interpose a colored adhesive layer or a fusion layer, and separate sheet-shaped resin foam layers each of which is adhered or fusion bonded onto each of outer sides, which are opposite sides of the adhesive layer or the fusion layer, of the sheet-shaped resin foams;

slice-processing the four-layered resin foam in a horizontal direction, which is perpendicular to a thickness direction of the resin foam, while maintaining the curved shape formed by the profile roll processing so as to cut across the adhesive layer between the two inner layers of the four-layered resin foam; and

forming the mountain parts and the valley parts only on the two inner resin layers and integrating the resin foams of the inner resin layer and the outer resin layer.

20. A method for using the cushioning material, wherein

flat faces of the cushioning material according to any one of claims 1 to 11 face each other; and

the cushioning materials are put on top of the other with their wavy-shaped concave-convex structure faces facing an outer surface and the flat faces facing each other so that the multiple linear patterns are formed side by side on the outer surface.

21. A method for using the cushioning material, wherein

a pair of the cushioning materials according to claim 9 are put on top of the other, laminating the cushioning materials having functionality;

the wavy-shaped concave-convex structure faces of the cushioning materials are put on top of the other so that the linear patterns are formed side by side on a substantially same plane; and

an apparent total occupancy rate of adhesive planes to an entire plane including the linear patterns is 80 % or more.

22. The method for using the cushioning material according to claim 20 or claim 21, wherein

the cushioning material can be used as both a partitioning material and an impact-absorbing wall panel material in shelters.

23. A connection structure of shelter partitions, the connection structure comprising:

the laminated bodies according to any one of claims 12 to 15, wherein each of the laminated bodies is in a generally rectangular shape where a length of a longer side of the substantial rectangular shape is twice a length of a shorter side;

the two laminated bodies as a mat for disaster use that can be used as a bed are disposed on a floor surface, contacting the longer sides of the substantial rectangular shape of the laminated bodies, so as to form a generally square section;

the laminated bodies stand in directions of the shorter sides of the substantial rectangular shape with the longer sides of the substantial rectangular shape contacting the floor surface so as to surround an outer periphery of the mat for disaster use as the generally square shaped floor material; and

a fixing means attached to an end part of the shorter side of the rear flat face of each of the laminated bodies is butted or fitted at substantially right angles with a fixing means attached to a flat part of a side end face of the shorter side, which is repeated a number of times to obtain a connection structure including at least a section having a sidewall formed into a generally square U shape with an open side.

24. The connection structure of shelter partitions according to claim 23, wherein

as fixing means that facilitate connection in assembling and separation in disassembling and are attached to surfaces of the laminated bodies, any of button-type fasteners or magnets attached to a tape-like member, or a loop-and-hook fastener having multiple micro-protrusions on a surface of the loop-and-hook fastener is used to connect and fix the laminated bodies.

25. The connection structure of shelter partitions according to either claim 23 or 24,

wherein

in the connection structure of the shelter partitions using the laminated bodies, each of the laminated bodies is cut in a straight line connecting positions of inflection points of the profile-processed surface of each of the laminated bodies so as to make a substantially parallel area that occupies a cut section of an end face of each of the laminated bodies as large as possible, and the fixing means is attached to a flat part of a shorter side end face formed in a generally rectangular shape.

26. The connection structure of shelter partitions according to any one of claims 23 to 25, wherein

the cushioning material according to any one of claims 1 to 11 is used instead of the laminated bodies.

27. A method for assembling a shelter partition, the method comprising:

using the laminated bodies according to any one of claims 12 to 15, the laminated bodies being in a generally rectangular shape where a length of a longer side of the generally rectangular shape is twice a length of a shorter side;

disposing on a floor surface the two laminated bodies as a mat for disaster use that can be used as a bed to form a generally square section by contacting the longer sides of the generally rectangular shape of the two laminated bodies;

standing the laminated bodies in directions of the shorter sides of the generally rectangular shape with the longer sides of the generally rectangular shape contacting the floor surface so as to surround an outer periphery of the mat for disaster use as the generally square-shaped floor material; and

connecting and fixing the laminated bodies by repeatedly butting and fitting at substantially right angles a fixing means attached to an end part of the shorter side of the rear flat face of the laminated bodies with a fixing means attached to a flat part of a side end face of the shorter side, and partitioning a section by forming a sidewall in a generally square U shape with an open side to obtain a shelter partition.

28. The method for assembling the shelter partition according to claim 27, the method further comprising:

forming a generally square-shaped mat for disaster use as a flooring material for a second section adjacent to the mat for disaster use as the flooring material for a first section, the mat for disaster use for the second section, which can also be used as a bed, having the similar size as the mat for disaster use for the first section; and

forming at least two U-shaped sections by using laminated bodies that are formed into another U-shaped sidewall having an opening in a direction opposite to the opening of the first section and sharing one end part side of the U shape with the first section so as to form the second section in succession to the first section.

29. The method for assembling the shelter partition according to claim 28, the method further comprising:
 - repeatedly forming the sidewall parts in turn by forming the U shapes with the openings of the substantially square section being opened in opposite directions in turn; and
 - repeatedly forming the generally square-shaped mat for disaster use as the generally square-shaped flooring material for each of the sidewall parts to form multiple sections.
30. The method for assembling the shelter partition according to any one of claims 27 to 29, wherein
 - the flooring material is disposed with either the flat face or the face having the wavy-shaped concave-convex structure facing the floor surface, and the U-shaped sidewall parts formed by the laminated bodies have a pattern-formed face having the wavy-shaped concave-convex structure and an opposite flat face alternating along each side of the section so that the laminated bodies are disposed facing outward, inward, and outward in turn, or inward, outward, and inward in turn.
31. The method for assembling the shelter partition according to any one of claims 27 to 30, wherein
 - for assembling the laminated bodies as the partitioning material, connecting and fixing means that facilitate connection in assembling and separation in disassembling are attached to surfaces of the laminated bodies, and any of button-type fasteners or magnets fixed on a tape-like member or a loop-and-hook fastener having multiple micro-protrusions on a surface of the loop-and hook fastener is used as the fixing means
32. The method for assembling the shelter partition according to claim 27 or 31, wherein
 - regarding that a distance between the adjacent mountain parts on a curve that alternately passes through the top parts of the mountain parts and the bottom parts of the valley parts is one pitch, the profile-processed surface of each of the laminated bodies is cut in a substantially straight line at a position a

quarter pitch shifted from top parts of the mountain parts or the valley parts, that is in a substantially straight line connecting the mean positions between the top parts of the mountain parts and the bottom parts of the valley parts, or the mean positions between the bottom parts of the valley parts and the top parts of the mountain parts, or, if the mean positions are inflection points, the profile-processed surface of each of the laminated bodies is cut in a straight line connecting positions of the inflection points so as to make a substantially parallel area that occupies a cut section of the end face of each of the laminated bodies as large as possible, and the fixing means is attached to the flat part of the shorter side end face formed in the generally rectangular shape.

33. The method for assembling the shelter partition according to any one of claims 27 to 32, wherein

the cushioning material according to any one of claims 1 to 11 is used instead of the laminated bodies.

34. A method for disassembling and storing the shelter partition formed by the method for assembling the shelter partition according to any one of claims 27 to 33, the method comprising:

attaching the fixing means at predetermined positions of both sides of the flat face of the laminated bodies;

disposing fixing means on a wall surface at predetermined positions corresponding to the positions of the fixing means disposed on the flat face;

disassembling the shelter partition including the laminated bodies;

facing the flat face of the laminated bodies toward the wall surface;

fixing the fixing means on the first laminated body to the fixing means on the wall surface so as to fix the standing laminated body to the wall surface;

placing a face with the wavy-shaped concave-convex structure of the second laminated body onto an opposite face of the flat face of the standing and fixed first laminated body, which has the wavy-shaped concave-convex structure, and aligning the end faces of the first laminated body and the second laminated body so as to make a pile of two layers;

placing the flat face and the face with the wavy-shaped concave-convex structure, which are stacking surfaces respectively, of the third and fourth new laminated bodies standing in turn in the same way as in the case of the first laminated body and second laminated body while aligning the stacking surfaces and the end faces;

further placing repeatedly the standing laminated bodies in the same procedure in turn according to the number of layers to be stacked; and

attaching fixing means to predetermined positions of the end faces of the laminated bodies, and fixing the fixing means on the end faces of the laminated bodies to another fixing means having a predetermined length and being fixed on the wall surface.

35. The method for disassembling and storing the shelter partition according to claim 34, wherein

the fixing means used for disassembling and storing the laminated bodies is the same as the fixing means used in assembling the laminated bodies, which facilitates separation in disassembling, and the fixing means is any of button-type fasteners or magnets fixed on the tape-like member or the loop-and-hook fastener having multiple micro-protrusions on a surface of the loop-and-hook fastener.

36. The method for disassembling and storing the shelter partition according to claim 34 or 35, wherein

regarding that a distance between the adjacent mountain parts on a curve that alternately passes through the top parts of the mountain parts and the bottom parts of the valley parts is one pitch, the profile-processed surface of the laminated body is cut in a substantially straight line at a position a quarter pitch shifted from top parts of the mountain parts or the valley parts, that is in a substantially straight line connecting the mean positions between the top parts of the mountain parts and the bottom parts of the valley parts, or the mean positions between the bottom parts of the valley parts and the top parts of the mountain parts, or, if these mean positions are inflection points, the profile-processed surface of the laminated body is cut in a straight line connecting positions of the inflection points so as to make a substantially parallel area that occupies a cut section of the end face of the laminated body as large as possible, and the fixing means is attached to the flat part of the shorter side end face formed in the generally rectangular shape.

37. The method for disassembling and storing the shelter partition according to any one of claims 34 to 36, wherein

the cushioning material according to any one of claims 1 to 11 is used instead of the laminated body.

38. A method for forming an impact-absorbing wall panel using the laminated bodies used in the method for assembling the shelter partition according to any one of claims 27 to 33, the method comprising:

attaching the fixing means at predetermined positions of both sides of the flat face of the laminated body;

disposing the fixing means on the wall surface at predetermined positions corresponding to the positions where the fixing means are arranged on the flat faces of the laminated bodies when the shorter sides of the laminated bodies as the standing faces are disposed in sequence parallel to the wall surface so that the longer side directions of the laminated bodies are adjoined to each other;

disassembling the shelter partition including the laminated bodies;

fixing the laminated body with the flat face facing toward the wall surface and the wavy-shaped concave-convex structure face facing toward an interior of a room by the fixing means disposed at the predetermined positions of the wall surface, corresponding to the positions where the fixing means of the laminated body are arranged;

facing the flat face of the other laminated body toward the wall surface;

similarly fixing the other laminated body with the wavy-shaped concave-convex structure face thereof facing the interior of the room by the fixing means disposed at the predetermined positions of the wall surface, corresponding to the positions where the fixing means of the laminated body are arranged, in succession to the first fixed laminated body; and

further fixing the other laminated bodies one after the other to the wall surface in succession to the laminated body that has been fixed immediately ahead so as to form the impact-absorbing wall panel for the shelter.

39. The method for forming the impact-absorbing wall panel for shelters according to claim 38, wherein

the fixing means used for disassembling the laminated bodies and forming the impact-absorbing wall panel is the same as the fixing means used in assembling the laminated bodies, which facilitates connection in assembling and separation in disassembling, and the fixing means is any of button-type fasteners or magnets fixed on the tape-like member or the loop-and-hook fastener having multiple micro-protrusions on its surface.

40. The method for forming the impact-absorbing wall panel for shelters according to anyone of claims 37 to 39, wherein

the cushioning material according to any one of claims 1 to 11 is used instead of the laminated body.