

DESCRIPTION

METHOD OF MANUFACTURING SHOCK ABSORBING SHEET WITH

SUPERIOR DESIGN SENSE AND SHOCK ABSORBING SHEET

TECHNICAL FIELD

5 [0001]

The present invention relates to a shock absorbing sheet capable of absorbing shocks when, for example, fitted in a shoe. The present invention also relates to a method of producing a sheet that can be provided with excellent design and pasted like a sticker to be used as a label and is applicable to fixtures, interior materials and the like of automobiles. More particularly, the present invention relates to a method of producing a sheet having excellent design which is suitably used in mules, sandals and pumps; and a shock absorbing sheet having excellent design.

BACKGROUND ART

[0002]

As cushion members for mitigating shocks applied to the feet during walking and the like, elastic materials such as elastomers are molded into prescribed shapes and arranged on shoe soles.

[0003]

In addition, in order to improve the decoration and fashionability of such cushion members, a cushion member for shoes, which comprises upper and lower cushion sheets composed of an elastic member and a decorative sheet

having decorated surfaces arranged between the cushion sheets, has been proposed (Patent Document 1).

[0004]

It is disclosed that the above-described cushion member proposed in Patent Document 1 is produced by molding each upper and lower cushion sheets and then bonding the resulting cushion sheets with a decorative sheet using an adhesive or by heat fusion.

[0005]

Meanwhile, Patent Document 2 discloses a cup insole comprising a surface material on a surface of a transparent elastomer, wherein, by setting the hardness of the elastomer at a specific value, a high shock absorbance is constantly maintained even in a low temperature range of 0°C or below.

PRIOR ART DOCUMENTS

PATENT DOCUMENTS

[0006]

[Patent Document 1] Japanese Utility Model No. 3151343

[Patent Document 2] Japanese Laid-open Patent Application (Kokai) No. 2007-195944

SUMMARY OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0007]

Patent Document 1 discloses a cushion member having a three-layer structure which comprises upper and lower

cushion sheets and a decorative sheet arranged therebetween. However, when producing such a cushion member having a three-layer structure using an adhesive as disclosed in Patent Document 1, in addition to a step of molding the respective cushion sheets, an extra step of coating each cushion sheet with the adhesive is required, which is not preferred from the economical standpoint.

[0008]

Meanwhile, when the present inventors examined a bonding method utilizing heat fusion, the heat applied during heat fusion caused a problem that the previously molded cushion sheets were softened and their molded shapes could not be maintained. Therefore, it was revealed that a cushion sheet marketable as a cushion member cannot be obtained. An object of the present invention is to maintain such molding property.

MEANS FOR SOLVING THE PROBLEMS

[0009]

In order to solve the above-described problems, the present inventors intensively studied and focused on the production process. As a result, the present inventors discovered that the above-described problems can be solved by molding a high-hardness first elastic member and then molding a low-hardness second elastic member when molding an elastomer as a material by using a die, thereby completing the present invention.

[0010]

That is, the present invention is a method of producing a shock absorbing sheet in which a first elastic member comprising an elastomer, a design sheet
5 and a second elastic member comprising an elastomer and having a hardness lower than that of the first elastic member are laminated in the order mentioned, the method comprising: a first molding step of molding the above-described first elastic member; and a second molding step
10 of molding the second elastic member after molding the first elastic member.

[0011]

In the above-described first molding step, it is preferred that the first elastic member be molded by
15 arranging a design sheet in a die used for molding the first elastic member and then pouring an elastomer thereon. Further, in the above-described second molding step, it is preferred that the second elastic member be molded by arranging a design sheet on the first elastic
20 member obtained in the above-described first molding step and then pouring an elastomer on the design sheet.

[0012]

Further, it is preferred that the method further comprise an annealing step and it is also preferred that
25 both sides of the above-described design sheet be processed with a binder.

[0013]

Further, it is preferred that a difference in hardness between the above-described first and second elastic members be larger than 5°. It is also preferred that the shock absorbing sheet be a shoe insole sheet in which the first elastic member is a foot-side elastic member and the second elastic member is a shoe-side elastic member.

[0014]

Moreover, another mode of the present invention is a shock absorbing sheet obtained by the above-described production method. Also, another mode of the present invention is a shock absorbing sheet being characterized in that a first elastic member comprising an elastomer, a design sheet and a second elastic member comprising an elastomer and having a hardness lower than that of the first elastic member are laminated in the order mentioned and that a difference in hardness between the above-described first and second elastic members is larger than 5°.

EFFECTS OF THE INVENTION

[0015]

According to the production method of the present invention, a shock absorbing sheet having excellent design which is capable of maintaining a molded shape by a simple method and can be distributed in the market, the sheet having a three-layer structure in which a design sheet is inserted; and a production method thereof can be

provided.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016]

[Fig. 1] Fig. 1 is a conceptual diagram which shows
5 a cross-section of the three-layer structure of a shock
absorbing sheet produced by the production method of the
present invention.

[Fig. 2] Fig. 2 is a conceptual diagram which views
a shock absorbing sheet produced by the production method
10 of the present invention from above.

MODE FOR CARRYING OUT THE INVENTION

[0017]

The present invention will now be described in
detail.

15 The present invention is a method of producing a
shock absorbing sheet having excellent design, in which
sheet a first elastic member, a design sheet and a second
elastic member having a hardness lower than that of the
first elastic member are laminated in the order mentioned.

20 The elastic members are composed of an elastomer.
The elastomer is not particularly limited as long as it
is a thermoplastic elastomer, and examples thereof
include vinyl chloride-based elastomers, styrene-based
elastomers, olefin-based elastomers, urethane-based
25 elastomers, polyester-based elastomers, polyamide-based
elastomers and nylon-based elastomers.

Among these elastomers, styrene-based elastomers are

particularly preferred, and examples thereof include styrene/butadiene-based thermoplastic elastomers (SBS) and styrene/ethylene/butylene-based thermoplastic elastomers (SEBS).

5 [0018]

The thermoplastic elastomer has a melting point of preferably 150°C or higher, more preferably 170°C or higher. When the melting point is equal to or lower than this, the thermoplastic elastomer is easily deformed by
10 heat and this may cause inconvenience in the production of a commercial product. Further, the melting point of the thermoplastic elastomer is preferably 220°C or lower, more preferably 210°C or lower. When the melting point is equal to or higher than this, it is required to apply
15 heat at a higher temperature during die molding, which is not preferred from the economical standpoint. In addition, such high-temperature heat causes thermal degradation of the thermoplastic elastomer.

[0019]

20 In order to make the surface pattern of the below-described design sheet visible, it is preferred that the respective elastic members be produced from a transparent or semi-transparent elastomer. The elastomer may be colored as long as it has transparency. In order to
25 improve the visibility of the pattern of the design sheet, it is preferred that the elastomer be transparent.

[0020]

By the surface design of the design sheet, the design property of a sheet produced by the production method of present invention is improved and also a member to which the sheet is mounted can be imparted with excellent design. The material of the design sheet is not particularly limited as long as a patterned or colored design can be formed on its surface; however, in order to prevent the shock-absorbing property of the resulting shock absorbing sheet from being deteriorated, it is preferred to employ a flexible material. Specific examples thereof include woven and nonwoven fabrics that are made of natural fibers such as cotton, hemp and wool; woven and nonwoven fabrics that are made of chemical fibers such as nylon; plastic films; papers; metal foils; and synthetic papers. Further, in order to improve the design, the design sheet can also be subjected to a lamé processing. The thickness of the design sheet is preferably 50 μm to 250 μm .

Further, the design on the design sheet is not particularly limited as long as it has a design property, and examples of such a design include figures, colors, letters and combinations thereof as well as floral and polka-dot patterns.

[0021]

In the production method of the present invention, a laminate comprising the first elastic member, the design sheet and the second elastic member is molded, and the

production method comprises: a first molding step of molding the first elastic member having a high hardness; and a step of molding the second elastic member having a low hardness after molding the first elastic member.

5 [0022]

<First Molding Step>

The first molding step is a step of molding the first elastic member having a higher hardness of the two elastic members. This first molding step is not particularly limited as long as it can mold the first elastic member, and the first elastic member can be usually molded by pouring an elastomer into a die or the like. Further, the shock absorbing sheet of the present invention comprises a design sheet and the design sheet may be molded in the first molding step together with the first elastic member by arranging it in a die, or it may be molded in the below-described second molding step together with the second elastic member.

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[0023]

In cases where the first elastic member is molded together with a design sheet in the first molding step, the design sheet is arranged in a die used for molding the first elastic member and the first elastic member is molded by pouring an elastomer thereon. First, in order to mold the first elastic member, a die for the first elastic member is prepared and an elastomer used as a material is poured and molded in the die. The

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temperature at which the molding is performed is not particularly limited and it may be any temperature as long as the elastomer is in a fluid state. The elastomer poured into the die is then allowed to cool to normal
5 temperature as is, without being taken out of the die. The cooling rate is also not particularly limited.

In the die used for molding the first elastic member, it is also possible to arrange a design sheet in advance and pour an elastomer thereon. In this manner, the first
10 elastic member is molded together with the design sheet.
[0024]

A preferred embodiment of the present invention is an insole sheet of a shoe and in this case, the first elastic member having a high hardness contacts human
15 barefoot and the second elastic member having a low hardness contacts the shoe. Further, in cases where the shock absorbing sheet of the present invention is used as a fixture of an automobile, a fall-prevention sheet or the like, a variety of members and articles are arranged
20 on the side of the high-hardness first elastic member. Therefore, the hardness of the first elastic member is preferably about 10° to 30°. By controlling the hardness in this range, the first elastic member can be made less likely to stick to the foot or various members and
25 articles and its shock and vibration-absorbing properties can be ensured as well. The hardness is more preferably 10° to 25°, still more preferably 10° to 20°. It is

noted here that the term "hardness" used herein refers to a value measured by a durometer in accordance with JIS K 6253.

Further, the layer thickness of the first elastic member is usually 1.5 mm to 3.5 mm, preferably 1.5 mm to 2.5 mm.

Moreover, also for the elastomer used as the material of the first elastic member of the present invention, the hardness is preferably 10° to 30°, more preferably 10° to 25°, still more preferably 10° to 20°. [0025]

It is preferred that the size of the design sheet contained in the shock absorbing sheet of the present invention be the same as or smaller than the upper-side elastic member. This is because, when the design sheet is larger than the upper-side elastic member, the design sheet is required to be cut so as to adjust the shape after molding. [0026]

It is preferred that both sides of the design sheet be processed with a binder. In cases where the material of the design sheet is a paper, a synthetic paper or the like, delamination may occur between the design sheet and the elastic members. Such interlayer delamination can be prevented by processing the both sides of the design sheet with a binder. This processing with a binder is performed by coating the surfaces of the design sheet

with a binder resin (organic). The coating method is not particularly limited and a commonly-used coating method or a method utilizing spraying, impregnation or printing may be employed.

5 [0027]

<Second Molding Step>

The first elastic member obtained in the first molding step is subsequently subjected to the second molding step, which is a step of molding the second
10 elastic member in such a manner that a design sheet is sandwiched between the first and second elastic members. In cases where the first elastic member is molded together with the design sheet in the first molding step, the second elastic member is molded on the design sheet.
15 Meanwhile, in cases where the first elastic member is solely molded in the first molding step, in the second molding step, the design sheet is arranged on the first elastic member and the second elastic member is molded on the design sheet. Specifically, a new die is fitted on
20 the die containing the first elastic member and an elastomer used as the material of the second elastic member is then poured into this newly fitted die, thereby molding the shock absorbing sheet of the present invention having excellent design. The temperature at
25 which the molding is performed is not particularly limited and it may be any temperature as long as the elastomer is in a fluid state. The molded shock

absorbing sheet of the present invention is then taken out of the die.

Further, it is also preferred that the first elastic member be molded such that a bowl-shaped edge is formed on its periphery and the second elastic member be molded such that it fills the recess formed by the bowl-shaped edge. By molding the respective elastic members in this manner, no area of adhesion exists between the two elastic members on the side of the resulting shock absorbing sheet; therefore, the shock absorbing sheet is allowed to have very good finish. Moreover, since the two elastic members are consequently not laminated in the periphery, the periphery can be finished thin, which is preferred when the shock absorbing sheet is used as a shoe insert sheet.

[0028]

In the above-described second molding step, there was a problem that the previously molded first elastic member was softened due to the heat applied during the elastomer molding and could not retain its molded shape. In order to solve this problem, the present inventors intensively studied and discovered that, by controlling the hardness of the second elastic member to be lower than that of the previously molded first elastic member, even when an elastomer for the second elastic member is poured and molded in a die, the first elastic member can sufficiently retain its molded shape and a laminate that

is marketable as a commercial product can be obtained.

[0029]

In order to control the hardness of the first elastic member to be higher than that of the second elastic member, elastomers that satisfy such a condition can be appropriately selected for the respective first and second elastic members. Further, in cases where the shock absorbing sheet is used as, for example, an insole sheet of a shoe, since it is required that the sheet be pasted to the sole of the shoe or other member serving as a base onto which the sheet is pasted, it is preferred that the second elastic member having a low hardness be arranged on the side of the shoe or the base. Specifically, the hardness of the second elastic member is preferably 10° or less, more preferably 5° or less.

Further, in cases where the shock absorbing sheet is used as a shoe insole sheet, the layer thickness of the above-described second elastic member is usually 0.5 mm to 2.0 mm, preferably 0.7 mm to 1.5 mm.

Moreover, also for the elastomer used as the material of the second elastic member of the present invention, the hardness is preferably 10° or less, more preferably 5° or less.

[0030]

The difference in hardness between the two elastic members is preferably larger than 5° . By controlling the difference in hardness in this manner, the molded shape

of the resulting molded article can be easily maintained.

Further, also for the elastomers used as the materials of the two elastic members, their difference in hardness is preferably larger than 5°. By controlling the difference in hardness in this manner, the molded shape of the resulting molded article can be easily maintained.

[0031]

Meanwhile, in order to allow the previously molded first elastic member to retain its molded shape against the heat from the elastomer poured thereon, it is preferred that the melting point of the elastomer used as the material of the first elastic member be higher than that of the elastomer used as the material of the second elastic member. Also by using elastomers having such property, the molded shape can be easily maintained.

[0032]

<Annealing Step>

In the shock absorbing sheet of the present invention molded by the above-described production steps, depending on the elastomers used, warping may occur during the post-molding cooling. This warping is believed to be caused by the difference in hardness between the two elastic members. Therefore, in order to correct the generated warpage, it is preferred that the sheet be subjected to an annealing step after being molded. This annealing is performed by heating the

molded article to a certain temperature to remove strains caused by molding. In the present invention, normally, the annealing is performed preferably at 65 to 85°C for 30 to 70 minutes, more preferably at 70 to 80°C for 50 to 60 minutes.

An apparatus used for the annealing is not particularly limited and a known apparatus, specific examples of which include a dryer and an oven, can be employed.

10 [0033]

When the shock absorbing sheet of the present invention having excellent design is arranged on a member, it is arranged in such a manner that one of the elastic members is in contact with the surface of the member on which the sheet is arranged. For example, in cases where the sheet of the present invention is used as an insole of a shoe, by arranging the sheet such that the shoe and the second elastic member come into contact with each other, not only the design provided on the design sheet can be recognized integrally with the shoe and the shoe can be imparted with excellent design property, but also the sheet can protect the feet as a shock absorbing sheet. In addition, by using the sheet of the present invention as an interior material or fixture of a car, the sheet can serve as a base or mat for vibration and shock absorption which has a colorful design. Furthermore, a function similar to that of a label or a sticker can be

given to the sheet of the present invention by pasting it on a window glass, wall, door or the like of a car or building.

EXAMPLES

5 [0034]

The present invention will now be described concretely by way of examples thereof; however, the present invention is not limited thereto.

[0035]

10 A sheet to be used as a shoe insole was molded by the following method.

<Example 1>

First, a styrene-based thermoplastic elastomer (hardness: 15°) and a styrene-based thermoplastic
15 elastomer (hardness: 5°) were prepared as an elastomer for the first elastic member to be arranged on the foot side (primary elastomer) and an elastomer for the second elastic member to be arranged on the shoe side (secondary elastomer), respectively. The fluid primary elastomer
20 heated to 210°C was poured into a die for the first elastic member (primary die) and allowed to cool to 40°C in the die over a period of 60 seconds, thereby molding the first elastic member.

After arranging a lamé-containing design sheet
25 treated with a binder resin (organic) on the molded first elastic member, a die for the second elastic member (secondary die) was fitted on the primary die and the

fluid secondary elastomer heated to 210°C was poured
thereinto and allowed to cool to room temperature over a
period of 5 to 10 minutes, thereby molding a sheet of the
present invention having excellent design. When the
5 primary and secondary dies were removed from the
resulting molded article, the molded article was found to
retain the molded shape although slight warpage was
observed.

[0036]

10 <Example 2>

First, a styrene-based thermoplastic elastomer
(hardness: 15°) and a styrene-based thermoplastic
elastomer (hardness: 5°) were prepared as an elastomer
for the first elastic member to be arranged on the foot
15 side (primary elastomer) and an elastomer for the second
elastic member to be arranged on the shoe side (secondary
elastomer), respectively. After arranging a lamé-
containing design sheet treated with a binder resin
(organic) on the cavity side of a die for the first
20 elastic member (primary die; male die), the fluid primary
elastomer heated to 210°C was poured into the die for the
first elastic member (primary die) and allowed to cool to
40°C in the die over a period of 60 seconds, thereby
molding the first elastic member comprising the design
25 sheet.

The obtained first elastic member comprising the
design sheet was transferred to a die for the second

elastic member (secondary die). Then, the fluid secondary elastomer heated to 210°C was poured thereinto and allowed to cool to room temperature over a period of 5 to 10 minutes, thereby molding a sheet of the present invention having excellent design. When the primary and secondary dies were removed from the resulting molded article, the molded article was found to retain the molded shape although slight warpage was observed.

[0037]

The molded articles obtained in Examples 1 and 2 were placed in a dryer and subjected to annealing at 80°C for 1 hour to remove warpage, thereby obtaining sheets of the present invention having excellent design. The obtained molded articles were both removed of warpage and retained the molded shapes; therefore, they were sufficiently marketable as shock-absorbing shoe insoles.

[0038]

<Comparative Example 1>

A sheet was molded in the same manner as in Example 1, except that a styrene-based thermoplastic elastomer (hardness: 5°) was used as the elastomer for the first elastic member (primary elastomer) and a styrene-based thermoplastic elastomer (hardness: 5°) was used as the elastomer for the second elastic member (p secondary elastomer). When the primary and secondary dies were removed from the resulting molded article, it was found that the molded article could not retain the molded

shapes corresponding to the dies.

INDUSTRIAL APPLICABILITY

[0039]

A shock absorbing sheet having excellent design
5 which is produced by the production method of the present
invention has good shock-absorbing properties as well as
excellent design property as a sheet having appropriate
viscosity and elasticity to be used as a shoe insole or
the like; therefore, the shock absorbing sheet is
10 suitably used in women's mules, sandals and pumps.
Further, by applying the shock absorbing sheet in a
fixture or interior material of a car, the shock
absorbing sheet can be advantageously used as an underlay
of various members and articles or as a vibration and
15 shock-absorbing member. Moreover, the shock absorbing
sheet can also be pasted to a window glass, a wall, a
door or the like to be used in a mode similar to a
sticker, a label or the like.

DESCRIPTION OF SYMBOLS

20 [0040]

- 1: Shock absorbing sheet
- 2: First elastic member
- 3: Second elastic member
- 4: Design sheet

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CLAIMS

1. A method of producing a shock absorbing sheet in which a first elastic member comprising an elastomer, a design sheet and a second elastic member comprising an elastomer and having a hardness lower than that of the first elastic member are laminated in the order mentioned, the method comprising:

a first molding step of molding the first elastic member; and

a second molding step of molding the second elastic member after molding the first elastic member.

2. The method of producing a shock absorbing sheet according to claim 1, wherein, in the first molding step, the first elastic member is molded by arranging a design sheet in a die used for molding the first elastic member and then pouring an elastomer thereon.

3 The method of producing a shock absorbing sheet according to claim 1, wherein, in the second molding step, the second elastic member is molded by arranging a design sheet on the first elastic member obtained in the first molding step and then pouring an elastomer on the design sheet.

4. The method of producing a shock absorbing sheet according to any one of claims 1 to 3, which further comprises an annealing step.

5. The method of producing a shock absorbing sheet according to any one of claims 1 to 4, wherein both sides

of the design sheet are processed with a binder.

6. The method of producing a shock absorbing sheet according to any one of claims 1 to 5, wherein a difference in hardness between the first and second elastic members is larger than 5°.

7. The method of producing a shock absorbing sheet according to any one of claims 1 to 6, wherein the shock absorbing sheet is a shoe insole sheet in which the first elastic member is a foot-side elastic member and the second elastic member is a shoe-side elastic member.

8. A shock absorbing sheet, obtained by the method of producing a shock absorbing sheet according to any one of claims 1 to 7.

9. A shock absorbing sheet, in which a first elastic member comprising an elastomer, a design sheet and a second elastic member comprising an elastomer and having a hardness lower than that of the first elastic member are laminated in the order mentioned, wherein

a difference in hardness between the first and second elastic members is larger than 5°.