(54) Titre : MOULAGE FABRIQUE A PARTIR DE POLYURETHANE ET PROCEDE DE PRODUCTION
(54) Title: MOLDING MADE FROM POLYURETHANE AND PROCESS FOR ITS PRODUCTION

(57) Abrégé/Abstract:
The present invention is directed to a polyurethane molding composed of at least two different polyurethane materials, namely a polyurethane gel and a polyurethane foam. The foam and the gel are arranged in layers one above another so that both materials act together as spring or damping element with respect to a load in the transverse direction. These moldings may preferably be used as seat cushions.
Abstract

The present invention is directed to a polyurethane molding composed of at least two different polyurethane materials, namely a polyurethane gel and a polyurethane foam. The foam and the gel are arranged in layers one above another so that both materials act together as spring or damping element with respect to a load in the transverse direction. These moldings may preferably be used as seat cushions.
Molding made from polyurethane and process for its production

The invention relates to a molding made from polyurethane, in particular a seat cushion, and a process for its production. The process for producing the molding comprises several alternatives within the framework of a mould casting process.

Polyurethanes are used in different morphologies, which have in each case found their areas of application. The use of polyurethane foam is known, for example for upholstered furniture parts, seats, in particular car seats, and for seat cushions. This material, when it is used in the seat field, is employed as a molding or cut from blocks.

In the automobile field for example, currently more than 80 % of all cars are fitted with seat cushions made from polyurethane foam. The comfort of these seat cushions is often inferior.

Gels made from polyurethane are also known for use as seat cushions.

Patent EP 57838 discloses gels for avoiding sagging and compression, which are characterized by a low characteristic, that is by so-called undercuring. They are produced by the reaction of a polyisocyanate with long-chain polyols, which should be free of short-chain portions. These dimensionally stable gels made from polyurethane raw materials may be used as mattresses, mattress inserts, automobile seats and upholstered furniture.

Patent EP 511570 discloses improved gels made from polyols and polyisocyanates having low characteristic, which are
produced from mixtures of long-chain and short-chain polyethers. Cushions in shoes, on bicycle saddles and on seat surfaces, supports to avoid and prevent injuries, face masks and upholstery under riding saddles, are mentioned, as possible applications.

The high weight and the high thermal capacity of seat cushions made from pure gel are disadvantageous. The high thermal capacity may lead to a cold seat feeling, since body warmth is removed perceptibly to heat a complete cushion made from gel.

The object of the invention now consists in overcoming the afore-mentioned disadvantages in the state of the art and to combine particularly good spring and damping properties of the molding in the load direction with pleasant seat comfort.

To achieve this object, the invention provides a molding made from polyurethane which is composed of at least two different polyurethane materials, namely of at least one polyurethane gel and at least one polyurethane foam, which are arranged in at least two different spatial regions of the molding, wherein the materials are joined by the implicit adhesive properties during foaming and/or curing of at least one of the polyurethane materials in the mold.

The molding may be produced in a mould casting process in a conventional mould, as is also used in the production of foam. The bond material integrated in the molding of the invention joins in optimum manner the spring or damping properties of the individual materials, so that a considerable advance with respect to the seat comfort results. Multi-layered arrangements of the different materials are also possible. Also regionally different arrangements, wherein for example the one material is arranged only in the region of the seat panel, may
advantageously be selected and used depending on the required properties.

The molding preferably comprises an outer covering layer which is impermeable particularly to the polyurethane gel.

The covering layer may consist of a film, in particular a polyurethane film, a polyvinyl chloride film or leather or a textile material, such as for example a microfibre material. In principle, various flexible materials are suitable as film material.

In a preferred embodiment of the invention, the polyurethane foam and the polyurethane gel are arranged in at least two layers one above another, so that the foam and the gel layered one above another act overall as a spring or damping element with respect to a load in the transverse direction.

In individual exemplary embodiments, a gel layer may be surrounded at least partly by foam or a foam block may be surrounded at least partly by a gel.

In a further development of the invention, the molding is designed as a seat cushion, wherein a textile cover layer is additionally present preferably at least on the side on the seat panel side. This applies particularly when a film has been used during rear-foaming. In this case, the cushion can later be conventionally covered.

If textiles are used externally in this embodiment of the invention, they should be sealed to be vacuum-tight towards the gel side. The use of a textile cover material directly as a covering layer is therefore not possible for simple, coarser textiles, since penetration of the still liquid gel material into the textile should be prevented. Films made from thermoplastic polyurethane or closed-cell,
cut polyurethane foam, may be used by way of example for
depositing a textile covering material.

The conventional polyols and polyisocyanates are reacted
with one another to produce the polyurethane foam. The
processing technology and the typical raw materials can be
found in the "Polyurethane Handbook", published by G.
Oertel.

Raw materials, as described in European patents EP 57838
and EP 511570, may be used for producing the gels.

The process for producing a molding made from polyurethane
according to the invention is characterized in that in a
mould casting process, a molding made from a polyurethane
gel composition and a foamable polyurethane reaction
mixture is produced, wherein the two compositions are
joined to one another during foaming and curing.

The fact that the sandwich construction of two different
polyurethanes utilizes the adhesive properties of this
material in optimum manner, has a particularly
advantageous effect on the molding produced.

The materials are preferably cast onto a covering layer,
which has been laid in the mould die, or the covering
layer is placed on the final bond material.

If required, the moldings produced may then also be
covered with a further material.

In one embodiment, the process may be carried out so that
a freshly produced mixture of polyol and polyisocyanate as
gel composition is introduced into a mould lined with a
covering layer, that a polyurethane raw material mixture
is then applied to the gel layer for the production of
foam, and that conditions for foaming and curing of the compositions are maintained in the mould.

According to a further embodiment of the process, a preformed gel layer may be introduced into the mould preferably lined with a covering layer, after which a polyurethane raw material mixture is applied for the production of foam and then conditions for foaming and curing of the molding are maintained in a conventional manner. That is, utilizing a certain residence time with a certain temperature profile.

The preformed gel layer may either be placed on the mould base or attached to the mould lid.

In a further alternative embodiment, a preformed foam block may also be placed in the mould, after which the mould is filled with a gel composition and the reaction conditions for producing the polyurethane gel from the gel composition are maintained.

The polyurethane gel is preferably produced from raw materials having an isocyanate functionality and a functionality of the polyol component of at least 5.2, preferably of at least 6.5, more preferably of at least 7.5.

In preferred embodiments, the polyol component for producing the gel consists of a mixture of
a) one or more polyols having hydroxyl numbers below 112, and
b) one or more polyols having hydroxyl numbers in the range 112 to 600, wherein the weight ratio of component a) to component b) lies between 90:10 and 10:90, the isocyanate characteristic of the reaction mixture lies in the range from 15 to 59.81, and the
product of isocyanate functionality and functionality of the polyol component is at least 6.15.

In a further specific exemplary embodiment, the raw materials for producing the gel consist of one or more polyisocyanates, and a polyol component consisting of one or more polyols (b₁) having hydroxyl numbers below 112, and one or more polyols (b₂) having hydroxyl numbers in the range 112 to 600, and optionally a catalyst for the reaction between isocyanate and hydroxyl groups, and optionally fillers and/or additives known per se from polyurethane chemistry, wherein the weight ratio of component (b₁) to component (b₂) lies between 90:10 and 10:90, the isocyanate characteristic of the reaction mixture lies in the range from 15 to 59.81, and the product of isocyanate functionality of the polyol component is at least 6.15.

The polyol component for producing the gel preferably consists of one or more polyols having a molecular weight between 1,000 and 12,000 and an OH number between 20 and 112, wherein the product of the functionalities of the polyurethane-forming components is at least 5.2, and the isocyanate characteristic lies between 15 and 60.

As isocyanates for gel production, those of the formula Q(NCO)ₙ may preferably be used, wherein n represents 2 to 4 and Q denotes an aliphatic hydrocarbon radical having 8 to 18 C atoms, a cycloaliphatic hydrocarbon radical having 4 to 15 C atoms, an aromatic hydrocarbon radical having 8 to 15 C atoms. The isocyanates may be used in pure form or in the form of the conventional isocyanate modifications, such as urethanisation, allophtantisation or biuretisation.
The invention is described in more detail below using exemplary embodiments, which should better explain the possible embodiments.

In one embodiment of the invention, a film or a textile, which is provided with a vacuum-tight film, is deep-drawn in a seat mould. The underside of the mould later represents the seat panel of the cushion. A freshly produced mixture of polyol and polyisocyanate is then introduced in liquid form into this mould. These gel starting materials completely or partly cover the seat panel after filling. After this mixture has reacted completely or partly to form a polyurethane gel, in the next step a liquid or pre-foamed mixture of polyurethane raw materials is introduced into the mould for the production of mould foam. The mixture foams, the lid of the mould is closed and after a curing time of conventionally between one to 10 minutes, the complete seat cushion is removed from the mould.

In a further embodiment of the invention, the polyurethane gel is produced separately and placed in the mould as a dimensionally stable gel in one piece or in sections. The gel is positioned on the film or on the laminated textile. After foaming in the mould, the gel is fixed at defined points of the seat panel by the polyurethane foam. Hence, the gel may specifically improve the comfort. In this embodiment, it is also possible to position a gel cushion on the mould lid. It is thus situated at the bottom after foaming. The seated feeling in a foam can thus advantageously be combined with the pressure-distributing properties of the polyurethane gel.

In a third embodiment of this invention, cut polyurethane foam and the gel are joined to one another by the reacting gel. This takes place such that the gel is cast onto a
deep-drawn film or a vacuum-tight textile, and then the foam is placed on the incompletely reacted gel. The intimate bond of gel and foam is produced during the completion reaction.
Claims:

1. A molding made from polyurethane, characterized in that it is composed of at least two different polyurethane materials at least one polyurethane gel and at least one polyurethane foam arranged in at least two different spatial regions of the molding, wherein the materials are joined during foaming and/or curing of at least one of the polyurethane materials in the mold.

2. The molding according to claim 1, characterized in that the molding comprises an outer covering layer which is impermeable to the polyurethane gel.

3. The molding according to claim 1 or 2, characterized in that the polyurethane foam and the polyurethane gel are arranged in at least two layers one above another.

4. The molding according to any one of claims 1 to 3, characterized in that a gel layer is surrounded at least partly by foam or a foam block is surrounded at least partly by a gel.

5. The molding according to any one of claims 2 to 4, characterized in that the outer covering layer consists of a film.

6. The molding according to claim 5, wherein the film is a polyurethane film, a polyvinyl chloride film, leather or a textile material.

7. The molding according to claim 6, wherein the textile material is a microfibre material.
8. The molding according to any one of claims 1 to 7, characterized in that the molding is a seat cushion.

9. The molding according to claim 8, characterized in that a textile cover layer is additionally present on the seat cushion.

10. A process for producing a molding made from polyurethane characterized in that in a mold casting process, a molding is produced from a polyurethane gel composition and a foamable polyurethane reaction mixture introduced sequentially into the mold, wherein the two compositions are joined to one another during foaming and curing.

11. The process according to claim 10, characterized in that the compositions are cast onto a covering layer or in that this covering layer is placed on a bond material.

12. The process according to claim 11, wherein the covering layer is a film.

13. The process according to claim 10 or 11, characterized in that a freshly produced mixture of polyol and polyisocyanate as gel composition is introduced into a mold lined with a covering layer and having a mold base and a mold lid, in that a polyurethane raw material mixture is then applied to the gel layer for production of foam, and in that conditions for foaming and curing of the compositions are maintained in the mould.

14. The process according to claim 10 or 11, characterized in that a preformed gel layer is introduced into the mould, in that a polyurethane raw material mixture is then applied for the production of foam and then conditions for foaming and curing of the molding are maintained.
15. The process according to claim 14, wherein the mold is lined with a covering layer.

16. The process according to claim 14, characterized in that the preformed gel layer is either placed on the mold base or attached to the mold lid.

17. The process according to claim 10 or 11, characterized in that a preformed foam block is placed in the mould, the mould is filled with a gel composition and the reaction conditions for producing the polyurethane gel from the gel composition are maintained.

18. The process according to any one of claims 13 to 17, characterized in that the gel compositions are produced using raw materials of an isocyanate functionality and a functionality of the polyol component of at least 5.2.

19. The process according to claim 18, wherein the functionality of the polyol component is at least 6.5.

20. The process according to claim 18, wherein the functionality of the polyol component is at least 7.5.

21. The process according to any one of claims 13 to 20, characterized in that the polyol component for producing the gel consists of a mixture of a) one or more polyols having hydroxyl numbers below 112, and

b) one or more polyols having hydroxyl numbers in the range 112 to 600, wherein the weight ratio of component a) to component b) lies between 90:10 and 10:90, the isocyanate characteristic of the reaction mixture lies in the range from 15 to 59.81, and the product of isocyanate functionality and functionality of the polyol component is at least 6.15.
22. The process according to any one of claims 10 to 21, characterized in that the raw materials for producing the gel consist of one or more polyisocyanates, and a polyol component consisting of one or more polyols (b₁) having hydroxyl numbers below 112, and one or more polyols (b₂) having hydroxyl numbers in the range 112 to 600, and optionally a catalyst for the reaction between isocyanate and hydroxyl groups, and optionally fillers and/or additives, wherein the weight ratio of component (b₁) to component (b₂) lies between 90:10 and 10:90, the isocyanate characteristic of the reaction mixture lies in the range from 15 to 59.81, and the product of isocyanate functionality of the polyol component is at least 6.15.

23. The process according to any one of claims 13 to 22, characterized in that the polyol component for producing the gel consists of one or more polyols having a molecular weight between 1,000 and 12,000 and an OH number between 20 and 112, wherein the product of the functionalities of the polyurethane-forming components is at least 5.2, and the isocyanate characteristic lies between 15 and 60.

24. The process according to any one of claims 10 to 23, characterized in that as isocyanates for gel production those of the formula

\[ Q(NCO)_n \]

are used, in which n represents 2 to 4 and Q denotes an aliphatic hydrocarbon radical having 8 to 18 C atoms, a cycloaliphatic hydrocarbon radical having 4 to 15 C atoms,
an aromatic hydrocarbon radical having 6 to 15 C atoms, or an araliphatic hydrocarbon radical having 8 to 15 C atoms.

25. The process according to claim 24, wherein the isocyanates are used in a pure form or as a modified isocyanate.

26. The process according to claim 25, wherein the modified isocyanate is modified by urethanisation, allophantisation or biuretisation.