

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 behavior of these seat cushions is occasionally assessed negatively.

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

Patent EP 57838 claims gels for avoiding decubitus, 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 protects 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, may be mentioned, inter alia, 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 production of the urethane.

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. Different, for example also multi-layered arrangements of the different materials, are 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 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 is conventionally covered later.

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, for example 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 conventional manner – that is a certain residence time with a certain temperature profile.

The preformed gel layer may, for example 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, also preferably of at least 7.5.

In preferred embodiments, the polyol component for producing the gel consists of a mixture of
one or more polyols having hydroxyl numbers below 112, and
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 (b_1) having hydroxyl numbers below 112, and
one or more polyols (b_2) 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 (b_1) to component (b_2) 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, allophantisiation 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 the 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 for example in 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.

Patent Claims:

1. Molding made from polyurethane, characterized in that it is composed of at least two different polyurethane materials, namely of
 - a) at least one polyurethane gel wherein the gel composition is produced using raw materials of an isocyanate functionality and a functionality of the polyol component of at least 5.2, and
 - b) at least one polyurethane foam,wherein said at least one polyurethane gel and said at least one polyurethane foam are arranged in at least two different spatial regions of the molding, wherein materials are joined by the implicit adhesive properties during production of the urethane.
2. Molding according to claim 1, characterized in that the molding comprises an outer covering layer which is impermeable particularly to the polyurethane gel.
3. 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. 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. Molding according to one of claims 2 to 4, characterized in that the covering layer consists of a film, in particular a polyurethane film, a polyvinyl chloride film or leather or a textile material, in particular a microfibre material.
6. Molding according to one of claims 1 to 5, characterized in that the molding is a seat cushion.

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7. Molding according to claim 6, characterized in that a textile cover layer is additionally present on the seat cushion, at least on the side on the seat panel side.
8. Process for producing a molding made from polyurethane, according to one of claims 1 to 7, 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.
9. Process according to claim 8, characterized in that the materials are cast onto a covering layer, preferably a film, or in that this covering layer is placed on the bond material.
10. Process according to claim 8 or 9, characterized in that a freshly produced mixture of polyol and polyisocyanate as gel composition is introduced into a mould lined with a covering layer, 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.
11. Process according to claim 8 or 9, characterized in that a preformed gel layer is introduced into the mould preferably lined with a covering layer, 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.
12. Process according to claim 11, characterized in that the preformed gel layer is either placed on the mould base or attached to the mould lid.
13. Process according to claim 8 or 9, characterized in that a preformed foam block is placed in the mould, in that the mould is filled with gel composition and in that the reaction conditions for producing the polyurethane gel from the gel composition are maintained.
14. Process according to one of claims 8 to 13, 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, preferably 6.5, in particular of at least 7.5.

15. Process according to one of claims 8 to 13, characterized in that the polyol component for producing the gel consists of a mixture of one or more polyols having hydroxyl numbers below 112, and 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.
16. Process according to one of claims 8 to 13, characterized in that the raw materials for producing 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 of 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.
17. Process according to one of claims 8 to 16, 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.

18. Process according to one of claims 8 to 17, characterized in that as isocyanate for gel production those of the formula



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, and

the isocyanates used may be in the pure form or in the form of the conventional isocyanate modifications, such as urethanisation, allophanisation or biuretisation.