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(54) Title: ACTIVATORS FOR THE PRODUCTION OF POLYURETHANE FOAMED MATERIALS

(57) Abrégé/Abstract:

Activators with reduced volatility that are liquid at room temperature are obtained as the reaction product of (A) a secondary amine or primary alcohol having at least one tertiary amine group, (B) a polyisocyanate of the diphenylmethane series having a functionality of from 2.5 to 4.0 and an OH-functional reactive component capable of addition to isocyanate. These activators are useful for the production of polyurethane foams having improved emission behavior.

ACTIVATORS FOR THE PRODUCTION OF POLYURETHANE FOAMS

ABSTRACT OF THE DISCLOSURE

Activators with reduced volatility that are liquid at room temperature are obtained as the reaction product of (A) a secondary amine or primary alcohol having at least one tertiary amine group, (B) a polyisocyanate of the diphenylmethane series having a functionality of from 2.5 to 4.0 and an OH-functional reactive component capable of addition to isocyanate. These activators are useful for the production of polyurethane foams having improved emission behavior.

ACTIVATORS FOR THE PRODUCTION OF POLYURETHANE FOAMED MATERIALS

The invention relates to activators having reduced volatility that are liquid at room temperature, which activators permit the production of polyurethane foams having improved emission behaviour.

In the production of cellular or compact polyurethanes, organometallic compounds and tertiary amines are mainly used as catalysts. A disadvantage of tertiary amines is their volatility. Various attempts at reducing the volatility of tertiary amines have been proposed. When higher molecular weight compounds are used, the price paid for lower volatility is lower activity, which must be compensated for by the addition of an increased amount of catalyst.

EP-A 176 013 teaches use of aminoalkylureas as activators. Such compounds already have reduced volatility and cause less contact discolouration of covering and lining materials adjacent to the polyurethanes, but their production requires long reaction times and their emission behaviour does not yet meet the increased demands of the automotive industry.

DE-OS 30 27 796 describes dialkylaminoalkylureas as activators for the production of polyurethane foams. These activators are prepared by reaction of secondary amines with diisocyanates in organic solvents and are obtained, after concentration, in the form of highly viscous to crystalline products. They must then be converted into a form suitable for the production of polyurethanes, since they cannot readily be processed in the form of the pure product. Such a conversion is complex and expensive.

It has now been found that particular urea derivatives/urethane derivatives, which can be obtained by reaction of specific amines with higher-functional polyisocyanates and isocyanate-reactive compounds, possess excellent solubility properties and exhibit low volatility and high activity. They cause extremely low emissions, even when subjected to heat, and do not damage other materials adjacent to the polyurethane. That is important in connection with the problem of fogging, that is to say emissions in the interior of a motor vehicle, especially under the effect of heat, which can impair adjacent materials and can be detected in the air inside the motor vehicle.

The present invention provides a process for the production of polyurethane foams in which there are used as activators reaction products of

A) a secondary amine or primary alcohol having at least one tertiary amino group,

B) a polyisocyanate of the diphenylmethane series having a functionality of from 2.5 to 4.0, preferably from 2.5 to 3.5, and

C) an OH-functional reactive component capable of addition to isocyanate, preferably having a number-average molecular weight of from 62 to 750.

The reaction is preferably carried out with a stoichiometric ratio between the isocyanate B) and the secondary amine or primary alcohol having at least one tertiary amino group A), that is to say an amino group or hydroxyl group of the secondary amine or primary alcohol having at least one tertiary amino group A) is present in the reaction mixture per NCO group of the isocyanate B). The reaction is preferably carried out such that the solvent component C) and component A) are placed in a vessel and the isocyanate B) is added at a temperature of from 20 to 50°C. When the addition of the isocyanate B) is complete, a subsequent reaction is carried out until no further free NCO groups are present in the reaction mixture. The subsequent reaction is generally carried out at temperatures of from 20 to 100°C, preferably from 40 to 60°C, particularly preferably at approximately 50°C, since at those temperatures the solvent C) reacts to only a small extent with the isocyanate B).

Polyurethane foams according to the invention are generally produced by reaction of

a) polyisocyanates or polyisocyanate prepolymers,
b) at least one component that is reactive towards isocyanate groups and has a functionality of from 2 to 6 and a number-average molecular weight of from 1000 to 15,000,
c) optionally chain-lengthening agents having a molecular weight of from 62 to 999,
d) activators according to the invention,
e) water,
f) optionally liquid CO_2 or organic blowing agents,
g) optionally stabilisers,
h) optionally further additives.

In a preferred embodiment, the polyurethanes are bonded to or manufactured with another material, for example coated with a film or produced by applying foam to the back of or spraying the back of a film.

There are preferably used as other materials TPO, PVC, ABS, mixtures of PVC, ABS, polyvinyl acetate, polyvinylbutyral, also homo- or co-polymers based on vinyl chloride, styrene, butadiene, isoprene, chloroprene, dichlorobutadiene, ethylene, propene or acrylonitrile in the form of films, coatings and edgings of various colours, also lacquers based on cellulose esters, polyester resins, epoxy resins, alkyd resins, as well as oil lacquers or lacquers of a combination of those components, textiles based on cotton or leather. In a preferred embodiment, polyolefins are used as other materials.

There are used as component a) in the process according to the invention organic di- or poly-isocyanates or polyisocyanate prepolymers. Suitable di- or poly-isocyanates are aliphatic, cycloaliphatic, araliphatic, aromatic and heterocyclic polyisocyanates, as are described in Justus Liebigs Annalen der Chemie 562 (1949) 75, for example those of the formula

$$Q(NCO)_n$$

in which

n represents an integer from 2 to 4, preferably 2, and

Q represents an aliphatic hydrocarbon radical having from 2 to 18, preferably from 6 to 10, carbon atoms, a cycloaliphatic hydrocarbon radical having from 4 to 15, preferably from 5 to 10, carbon atoms, an aromatic hydrocarbon radical having from 6 to 15, preferably from 6 to 13, carbon atoms, or an araliphatic hydrocarbon radical having from 8 to 15, preferably from 8 to 13, carbon atoms.

Preference is given to polyisocyanates as described in DE-OS 28 32 253. In general, particular preference is given to the use of the technically readily accessible polyisocyanates, for example 2,4- and 2,6-toluylene diisocyanate as well as any desired mixtures of those isomers ("TDI"), polyphenyl-polymethylene polyisocyanates, as are prepared by aniline-formaldehyde condensation and subsequent phosgenation ("crude MDI"), and polyisocyanates containing carbodiimide groups, urethane groups, allophanate groups, isocyanurate groups, urea groups or biuret groups ("modified polyisocyanates"), especially those modified polyisocyanates which are derived from 2,4- and/or 2,6-toluylene diisocyanate or from 4,4'- and/or 2,4'-diphenylmethane diisocyanate. It is also possible to use prepolymers of the mentioned isocyanates and organic compounds having at least one hydroxyl group. There may be mentioned by way of example polyols or polyesters having from one to four hydroxyl groups and having (number-average) molecular weights of from 60 to 1400. Very particular preference is given to the use of the polyisocyanates that are obtainable technically under the name "polymeric diphenylmethane diisocyanate" and have a functionality greater than 2.0, mixtures thereof with diphenylmethane diisocyanate or ternary mixtures of polymeric diphenylmethane diisocyanate, diphenylmethane diisocyanate and toluylene diisocyanate, as well as prepolymers prepared from the mentioned isocyanates.

According to the invention, polyol component b) contains at least one component that is reactive towards isocyanate groups and has a functionality of from 2 to 6 and a number-average molecular weight of from 1000 to 15,000. Such a component may be, for example, polyether polyols such as poly(oxyalkylene) polyols or polyester polyols or combinations thereof.

Poly(oxyalkylene) polyols that may be used according to the invention can be prepared, for example, by polyaddition of alkylene oxides to polyfunctional starter compounds in the presence of basic catalysts. Preferred starter compounds are molecules having from two to six hydroxyl groups per molecule, such as water, triethanolamine, 1,2-ethanediol, 1,2-propanediol, 1,3-propanediol, diethylene glycol, dipropylene glycol, triethylene glycol, tripropylene glycol, 1,2-butanediol, 1,3-butanediol, 1,4-butanediol, 1,2-hexanediol, 1,3-hexanediol, 1,4-hexanediol, 1,5-hexanediol, 1,6-hexanediol, glycerol, trimethylolpropane, pentaerythritol, or sorbitol. Further possible starter compounds are ammonia or compounds having at least one primary or secondary amino group, such as, for example, aliphatic amines such as 1,2-diaminoethane, oligomers of 1,2-diaminoethane (for example diethylenetriamine, triethylenetetramine or pentaethylenehexamine), ethanolamine or diethanolamine, 1,3-diaminopropane, 1,3-diaminobutane, 1,4-diaminobutane, 1,2-diaminohexane, 1,3-diaminohexane, 1,4-diaminohexane, 1,5-diaminohexane, 1,6-diaminohexane, aromatic amines such as 1,2-diaminobenzene, 1,3-diaminobenzene, 1,4-diaminobenzene, 2,3-diaminotoluene, 2,4-diaminotoluene, 3,4-diaminotoluene, 2,5-diaminotoluene, 2,6-diaminotoluene, 2,2'-diaminodiphenylmethane, 2,4'-diaminodiphenylmethane, 4,4'-diaminodiphenylmethane, or aromatic amines that are obtained by acid-catalysed condensation of aniline with formaldehyde. The starter compounds may be used alone or in a mixture.

Alkylene oxides that are preferably used for the preparation of the poly(oxyalkylene) polyols are oxirane, methyloxirane and ethyloxirane. They may be used alone or in a mixture. When used in a mixture, it is possible to react the alkylene oxides randomly or block-wise or both in succession. Further details are to be found in "Ullmanns Encyclopädie der industriellen Chemie", Volume A21, 1992, p. 670 f.

Suitable poly(oxyalkylene) polyols may also be a dispersion of a graft polymerisation product in a poly(oxyalkylene) polyol. That polymerisation product may be prepared, for example, by radical *in situ* polymerisation of acrylonitrile and/or styrene in a poly(oxyalkylene) polyol, for example according to the method of US-PS 3 523 093. Other polymerisation products are, for example, polyurea compounds, polyhydrazides, or polyurethanes containing tertiary amino groups. Suitable methods for the preparation of dispersions of such polymerisation products are described, for example, in EP-A 11 752, US-PS 4 374 209 and DE-OS 32 31 497. The proportion of polymerisation products in the dispersion is preferably from 1 to 50 wt.%.

It is also possible to use in polyol component b) one or more polyester polyols having (number-average) molar masses of from 1000 to 30,000 g/mol., preferably from 1000 to 10,000 g/mol., particularly preferably from 2000 to 6000 g/mol., of aromatic and/or aliphatic dicarboxylic acids and polyols having at least two hydroxyl groups. Examples of dicarboxylic acids are phthalic acid, isophthalic acid, terephthalic acid, fumaric acid, maleic acid, azelaic acid, glutaric acid, adipic acid, suberic acid, sebacic acid, malonic acid and succinic acid. The pure dicarboxylic acids as well as any desired mixtures thereof may be used. Instead of the free dicarboxylic acids, the corresponding dicarboxylic acid derivatives, such as, for example, dicarboxylic acid mono- or di-esters of alcohols having from one to four carbon atoms, may also be used. Such esters are formed, for example, in the recycling of polyester waste. It is also possible to use as the acid component dicarboxylic acid anhydrides, such as phthalic anhydride or maleic anhydride. There is used as the alcohol component for the esterification preferably: ethylene glycol, diethylene glycol, tetraethylene glycol, 1,2-propanediol, 1,3-propanediol, 1,4-butanediol, 1,5-pentanediol, 1,6-hexanediol, 1,10-decanediol, glycerol, trimethylolpropane, pentaerythritol, or mixtures thereof. It is also possible to use polyester polyols of lactones, for example ε-caprolactone, or hydroxycarboxylic acids, for example ω-hydroxycarboxylic acids.

The polyol component b) may also contain polyether ester polyols, as are obtainable, for example, by reaction of phthalic anhydride with diethylene glycol and subsequent reaction with oxirane.

Further examples of suitable polyols which may be present in polyol component b) are polyfunctional alcohols or amines or amino alcohols or mixtures thereof as well as their propoxylated and/or ethoxylated secondary products, or also polyester polyols that are obtained by esterification of polyfunctional alcohols with polyfunctional carboxylic acids. Polyol component b) preferably has a content of primary hydroxyl groups of at least 75 %.

As component c) there are optionally used chain-lengthening agents or crosslinking agents having a molecular weight of from 62 to 999 g/mol., for example glycerol, glycols, sorbitol, alkanolamines or the alkoxylation products thereof. It is possible to use both aromatic and aliphatic lengthening agents. In addition to hydroxy-functional chain-lengthening agents or crosslinking agents, amino-functional chain-lengthening agents or crosslinking agents may also be used.

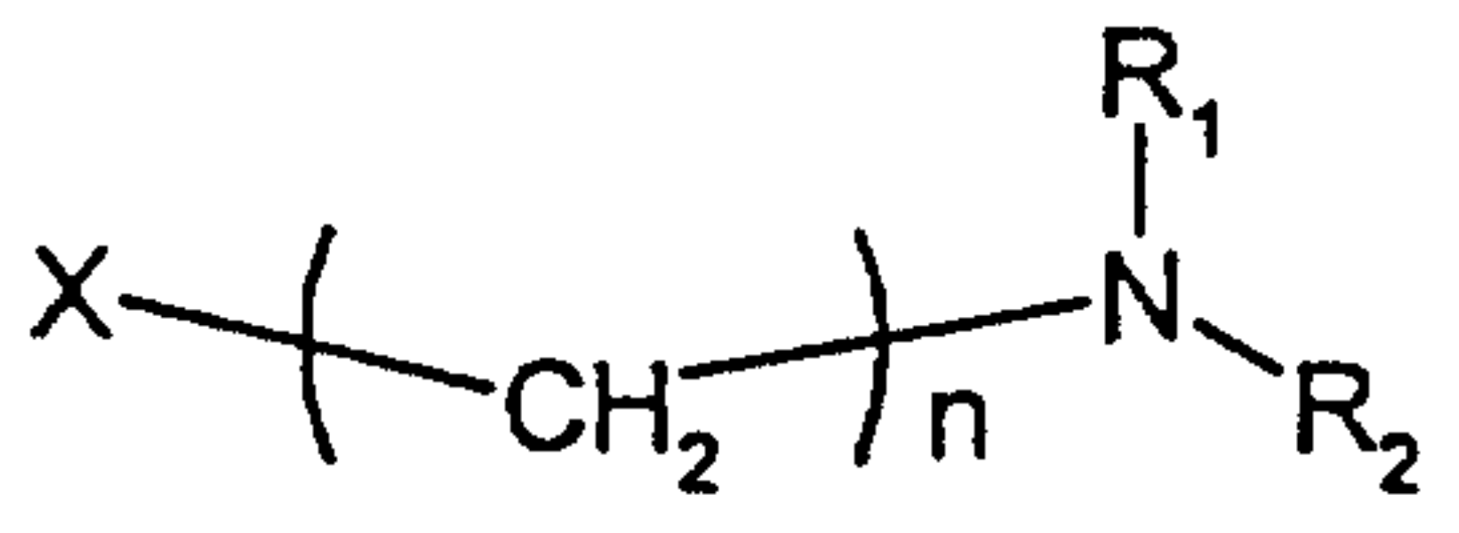
According to the invention there are used as activators d) reaction products of

A) a secondary amine or primary alcohol having at least one tertiary amino group,

B) a polyisocyanate of the diphenylmethane series having a functionality of from 2.5 to 4.0, preferably from 2.5 to 3.5, and

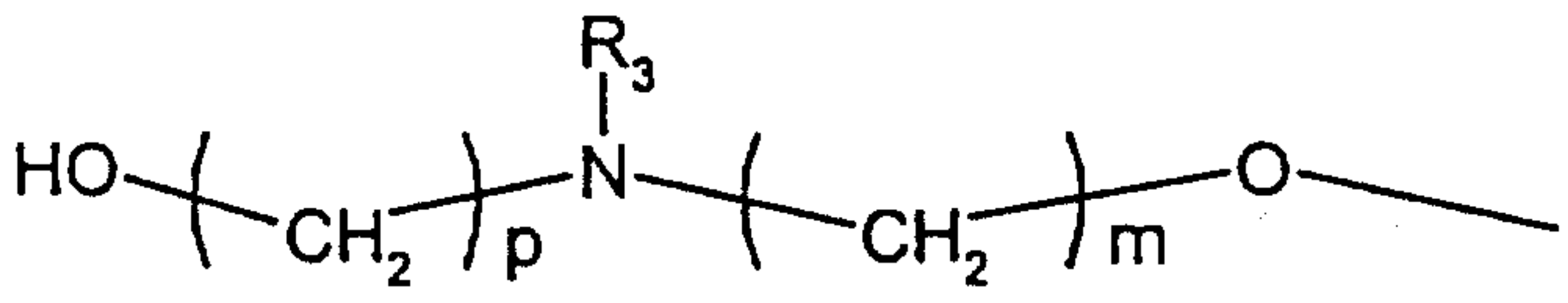
C) as solvent, an OH-functional reactive component capable of addition to isocyanate.

There are used as component A) preferably bis(dialkylaminoalkyl)amines or N-hydroxyalkyl bis(tert.-aminoalkyl) ethers. Special preference is given to compounds of the general formula



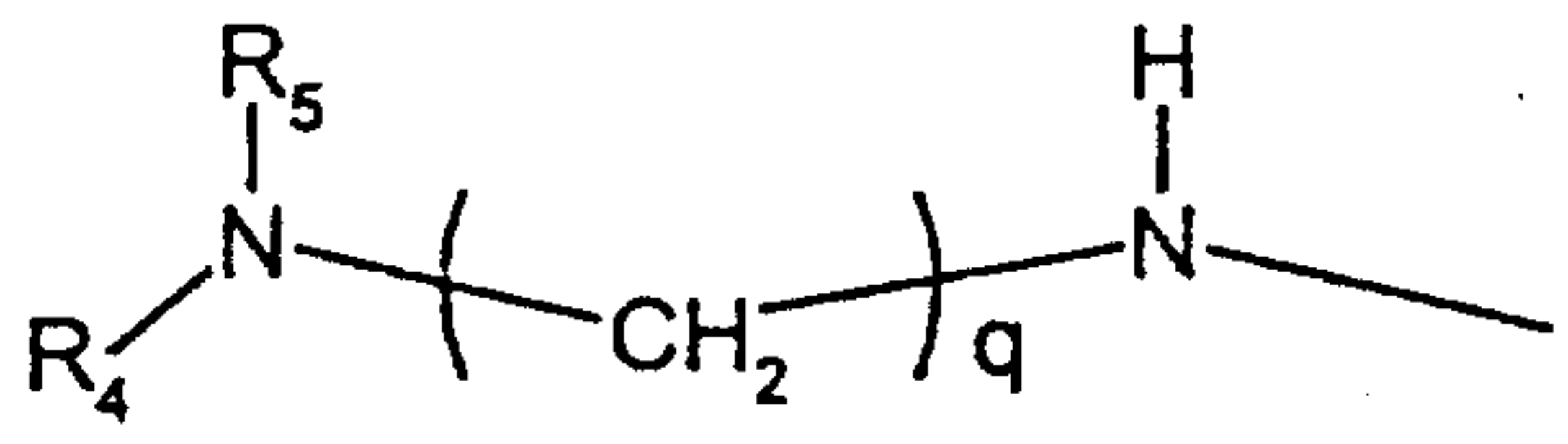
$$X-(CH_2)_n-N(R_1)-R_2$$

wherein X =



$$HO-(CH_2)_p-N(R_3)-(CH_2)_m-O-$$

or



$$R_4-N(R_5)-(CH_2)_q-N(H)-$$

wherein

n, m, p, q are integers from 2 to 5, which may be identical or different, and

R_1, R_2, R_3, R_4, R_5 represent C_1-C_5-alkyl, preferably methyl.

The use of bis(3-(N,N-dimethylamino)propyl)amine or 2-hydroxyethyl-trimethyl-diaminodiethyl ether as component A) is particularly preferred.

There are used as component B) preferably polyisocyanates of the diphenylmethane series having a polynuclear proportion of at least 20 %.

Component C) acts as solvent for the addition products formed by reaction of components A) and B). It is usually used in amounts such that the concentration of the addition products of A) and B) in component C) is from 20 to 60 wt.%.

Examples of compounds that may be used as component C) are dipropylene glycol, tripropylene glycol, triisopropanolamine, or addition products of propylene oxide and triethanolamine.

The activators d) are usually used in an amount of from 0.1 to 10 parts by weight, preferably from 1 to 5 parts by weight, based on 100 parts of the polyol components b) and c).

As component e), water is used as a chemical blowing agent in an amount of from 0.5 to 7.0 wt.%, preferably from 1.0 to 4.0 wt.%, based on sum of components b) and c).

The reaction mixture may additionally contain liquid CO_2 or organic blowing agents f) as physical blowing agents, for example hydrocarbons, such as cyclopentane, isopentane, and n-pentane; halogenated hydrocarbons, such as dichloromethane, dichloromonofluoromethane, difluoromethane, trifluoromethane, difluoroethane, 1,1,1,2-tetrafluoroethane, tetrafluoroethane (R 134* or R 134a*), 1,1,1,4,4,4-hexafluorobutane (R 356*), 1,1,1,3,3-pentafluoropropane (R 245fa*), 1,1,1,3,3-pentafluorobutane (R 365mfc*), chlorodifluoroethanes, 1,1-dichloro-2,2,2-trifluoroethane, 2,2-dichloro-2-fluoroethane, heptafluoropropane or sulfur hexafluoride. Mixtures of those blowing agents may also be used. Other suitable blowing agents are carboxylic acids, such as formic acid, acetic acid, oxalic acid, and chemical blowing agents that liberate gases in the course of the foaming process,

*trade-mark

such as, for example, azo compounds. Such blowing agents are preferably used in combination with water.

There are used as stabilisers g) especially polyether siloxanes, especially water-soluble examples thereof. The structure of those compounds is generally such that a copolymer of ethylene oxide and propylene oxide is bonded to a polydimethylsiloxane radical. Such stabilisers are described, for example, in US-A 2 834 748, US-A 2 917 480 and US-A 3 629 308. Of particular interest are polysiloxane-polyoxyalkylene copolymers according to DE-OS 25 58 523 that are branched a plurality of times *via* allophanate groups.

In the production of the polyurethane foams according to the invention, further auxiliary substances and additives h) may optionally also be added. Examples are flameproofing agents such as, for example, tricresyl phosphate, tris-(2-chloroethyl) phosphate, tris-(2-chloropropyl) phosphate, tris-(2,3-dibromopropyl) phosphate, tetrakis-(2-chloroethyl)ethylene diphosphate, dimethylmethane phosphonate, diethanolaminomethylphosphonic acid diethyl ester, as well as halogen-containing polyols having a flameproofing action. It is also possible to use concomitantly paraffins or fatty alcohols or dimethylpolysiloxanes as well as pigments or colourings, also stabilisers against the effects of ageing and weathering, plasticisers such as dioctyl phthalate, and substances having a fungistatic and bacteriostatic action, as well as fillers such as barium sulfate, kieselguhr, carbon black or prepared chalk. These substances are usually added to the polyol component in amounts of from 0 to 10 parts by weight, preferably from 0 to 5 parts by weight.

Further examples of surface-active additives and foam stabilisers that may optionally be used concomitantly, as well as cell regulators, retarding agents, stabilisers, flame-retardant substances, colourings and fillers, as well as substances having a fungistatic and bacteriostatic action, and details regarding the use and the action of such additives, are described in G. Oertel (eds.): "Kunststoff-Handbuch", Volume VII, Carl Hanser Verlag, 3rd edition, Munich 1993, p. 110-115.

Examples

Description of the starting materials

Polyol 1:	Polyether polyol having an OH number of 28 and at least 80 % primary OH groups, prepared by addition of propylene oxide/ethylene oxide (83/17) to trimethylolpropane as starter.
Polyol 2:	Polyether polyol having an OH number of 28 and at least 80 % primary OH groups, prepared by addition of propylene oxide/ethylene oxide (83/17) to trimethylolpropane as starter and having a grafted filler content of 20 wt.% of styrene/acrylonitrile (40/60 %).
Polyol 3:	Polyether polyol having an OH number of 500, prepared by addition of propylene oxide to triethanolamine as starter.
Polyisocyanate 1:	Polyisocyanate of the diphenylmethane series that has been obtained by phosgenation of an aniline/formaldehyde condensation product, having a content of 45 wt.% diphenylmethane diisocyanate and 55 wt.% higher homologues, that has an isocyanate content of 31.5 wt.% and a functionality >2.5.
Polyisocyanate 2:	Polyisocyanate of the diphenylmethane series that has been obtained by phosgenation of an aniline/formaldehyde condensation product, having a content of 35 wt.% diphenylmethane diisocyanate and 65 wt.% higher homologues, that has an isocyanate content of 31.5 wt.% and a functionality >2.7.

Polyisocyanate 3: Polyisocyanate of the diphenylmethane series that has been obtained by phosgenation of an aniline/formaldehyde condensation product, having a content of 30 wt.% diphenylmethane diisocyanate and 70 wt.% higher homologues, that has an isocyanate content of 31.5 wt.% and a functionality >2.8.

Polyisocyanate 4: Diisocyanatodiphenylmethane, containing 55 % 2,4'-isomer and 45 % 4,4'-isomer.

Polyisocyanate 5: Polyisocyanate of the diphenylmethane series that has been obtained by phosgenation of an aniline/formaldehyde condensation product, having a content of 90 wt.% diphenylmethane diisocyanate and 10 wt.% higher homologues, that has an isocyanate content of 31.5 wt.% and a functionality of 2.15.

Preparation of the activators

Example 1

93.5 g of bis(3-(N,N-dimethylamino)propyl)amine and 295 g of polyether polyol 3 were placed in a vessel, and 65.6 g of polyisocyanate 2 were added dropwise in the course of 5 minutes, with vigorous stirring, at room temperature, the temperature being maintained at 40°C by cooling. Stirring was then continued for a further 30 minutes at 50°C. A product having an amine number of 240 mg KOH/g and a viscosity of 3390 mPa s (25°C) was obtained; the product is stable to storage for more than 6 months.

Example 2

93.5 g of bis(3-(N,N-dimethylamino)propyl)amine and 295 g of polyether polyol 3 were placed in a vessel and reacted with 65.6 g of polyisocyanate 3 analogously to Example 1. A product having an amine number of 240 mg KOH/g and a viscosity of 3730 mPa s (25°C) was obtained; the product is stable to storage for more than 6 months.

Example 3

93.5 g of bis(3-(N,N-dimethylamino)propyl)amine and 295 g of dipropylene glycol were placed in a vessel and reacted with 65.6 g of polyisocyanate 2 analogously to Example 1. A product having an amine number of 130 mg KOH/g and a viscosity of 842 mPa s (25°C) was obtained; the product is stable to storage for more than 6 months.

Example 4 (comparison)

93.5 g of bis(3-(N,N-dimethylamino)propyl)amine and 295 g of polyether polyol 3 were placed in a vessel and reacted with 62.5 g of polyisocyanate 4 analogously to Example 1. There was obtained a product having an amine number of 238 mg KOH/g, which slowly turned cloudy; the reaction product crystallised out within 4 weeks.

Example 5 (comparison)

187 g of bis(3-(N,N-dimethylamino)propyl)amine and 542 g of polyether polyol 3 were placed in a vessel and reacted with 125 g of polyisocyanate 5 analogously to Example 1. There was obtained a product having an amine number of 235 mg

KOH/g, which showed cloudiness after 2 days; the reaction product crystallised out completely within 2 weeks.

Example 6

95 g of N-2-hydroxyethyl N,N',N'-trimethyldiaminodiethyl ether and 279 g of polyether 3 were placed in a vessel and reacted with 66 g of polyisocyanate 2 analogously to Example 1. A product having an amine number of 230 mg KOH/g and a viscosity of 2010 mPa s (25°C) was obtained; the product is stable to storage for more than 6 months.

Foaming examples

Examples 7 to 10

Polyurethane free foams were produced using the formulations indicated in the table. To that end, polyol, water and activator were pre-mixed, the isocyanate was then added, and the reaction mixture was homogenised for 10 seconds at 1200 rpm and then poured into a sheet mould to the base of which there had previously been fixed a commercially available PVC film having a size of 10 cm x 10 cm and a thickness of approximately 1 mm.

Example	**7**	**8**	**9***	**10***
Polyol 1	69.7	69.7	70.7	70.7
Polyol 2	22.0	22.0	23.0	23.0
Polyol 3	3.5	3.5	5.5	5.5
Water	2.8	2.8	2.8	2.8
Activator Example 1	3.0	-	-	-
Activator Example 2	-	3.0	-	-
Dimethylaminopropylurea	-	-	0.6	-
Dabco* 33 LV	-	-	-	0.6
Polyisocyanate 1	50	50	50	50
Start time [s]	19	19	18	17
Rising time [s]	97	98	97	95
Bulk density [kg/m^3]	62	62	62	61

*comparison example not according to the invention

Ageing behaviour of the foams

The fogging behaviour of the foams that had been produced was tested in accordance with DIN 75201/B. As further criteria there were used for determining temperature-dependent emissions, a dynamic process (DaimlerChrysler specification "PB VW T 709" for determining gaseous and condensable emissions from motor vehicle interior finishing materials with thermodesorption) as well as a static process (Audi/VW test specification "PV 3341" for non-metallic materials of motor vehicle interior finishing for determining the emission of organic compounds).

In the case of the dynamic process for determining gaseous emissions (VOC value), the sample (weighed portion from 10 to 30 mg) was enclosed in an empty glass tube and heated for 30 minutes at 90°C. The volatile sample constituents emitted during the heating were separated by freezing at -150°C and were then freed again by sudden

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*trade-mark

heating to 280°C, separated on the capillary column of a gas chromatograph and detected using a mass-selective detector.

Following the determination of the gaseous emissions, the condensable emissions (FOG value) are detected using the same sample. To that end, the sample is left in the apparatus and heated for 60 minutes at 120°C. The volatile sample constituents emitted during the heating are in turn separated by freezing at -150°C and are then freed again by sudden heating to 280°C, separated on the capillary column of a gas chromatograph and detected using a mass-selective detector.

In the static process for determining temperature-dependent emissions, an amount of sample of 1.0 g/10 ml jar volume is weighed into a headspace analysis jar and, before the measurement, adjusted to a temperature of 120°C for 5 hours in the gas-tight sealed analysis jar. The samples in the temperature-controlled sample jar are analysed with the aid of a headspace sampler over the capillary column of a gas chromatograph.

Example	**7**	**8**	**9***	**10***
Fogging [mg] according to DIN 75201/B	0.07	0.08	0.37	0.08
Emissions [ppm][1]				
FOG value	32	32	105	85
VOC value	13	13	52	250
Emissions [ppm][2]	5	5	19.5	11.5

*comparison example not according to the invention

[1] dynamic process for determining temperature-dependent emissions

[2] static process for determining temperature-dependent emissions

For determining film damage, the elongation at tear of the foam-backed PVC films was determined in accordance with DIN 53504. The initial value of the film used was 290 %; the elongation at tear of a film stored for 500 hours at 120°C was 280 %.

A film foam-backed according to Example 1 was stored for 500 hours at 120°C, and the foam was then peeled off the film. The film exhibited no change in colour. The elongation at tear of the film so obtained was 270 %.

CLAIMS:

1. An activator which is the reaction product of
   - A) a secondary amine or primary alcohol having at least one tertiary amino group,
   - B) a polyisocyanate of the diphenylmethane series having a functionality of from 2.5 to 4.0, and
   - C) an OH-functional reactive component capable of addition to isocyanate.

2. A process for the production of polyurethanes comprising reacting a polyisocyanate and an isocyanate-reactive material in the presence of the activator of Claim 1.

3. A low-emission polyurethane produced by the process of Claim 2.

4. A molding composed of a polyurethane and at least one other material in which the polyurethane is the polyurethane is produced by the process of Claim 2.

5. An activator which is the reaction product of
   - A) a secondary amine having at least one tertiary amino group,
   - B) a polyisocyanate of the diphenylmethane series having a functionality of from 2.5 to 4.0, and
   - C) an OH-functional reactive component capable of addition to isocyanate.

6. An activator which is the reaction product of
   - A) a secondary amine or primary alcohol having at least one tertiary amino group,

B) a polyisocyanate of the diphenylmethane series having a functionality of from 2.5 to 4.0, and

C) an OH-functional reactive component capable of addition to isocyanate having a number average molecular weight of from 62 to 750.

7. An activator which is the reaction product of

A) a secondary amine or primary alcohol corresponding to the formula

$$X(CH_2)_nNR_1R_2$$

in which

$$\text{X represents } HO(CH_2)_pNR_3((CH_2)_{m-o-}) \text{ or}$$

$$R_4NR_5((CH_2)_q\text{—}NH\text{—})$$

in which

n, m, p, and q each represent an integer from 2 to 5, and R_1, R_2, R_3, R_4, and R_5 each represent a C_1—C_5—alkyl group,

B) a polyisocyanate of the diphenylmethane series having a functionality of from 2.5 to 4.0, and

C) an OH-functional reactive component capable of addition to isocyanate.