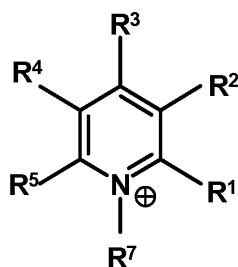
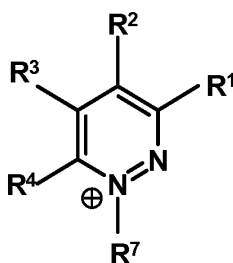


Claims

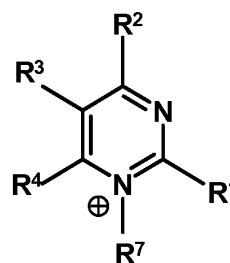
1. A process for preparing high-reactivity isobutene homo- or copolymers with a content of terminal vinylidene double bonds per polyisobutene chain end of at least 70 mol%, which comprises polymerizing isobutene or an isobutene-comprising monomer mixture in the presence at least one Lewis Acid effective as a polymerization catalyst, selected from the group consisting an aluminum trihalide-donor complex, an alkylaluminum halide-donor complex, an iron trihalide-donor complex, a gallium trihalide-donor complex, a titanium tetrahalide-donor complex, a zinc dihalide-donor complex, a tin dihalide-donor complex, and a tin tetrahalide-donor complex, effective as a polymerization catalyst, said complex comprising, as the donor, a mixture of
- at least organic compound (II) comprising at least one oxygen or nitrogen atom with at least one lone electron pair, preferably comprising at least one oxygen atom with at least one lone electron pair, very preferably selected from the group consisting of organic compounds with at least one ether function, organic compounds with at least one carboxylic ester function, organic compounds with at least one aldehyde function, organic compounds with at least one keto function, and organic compounds with at least one nitrogen containing heterocyclic ring, and
 - at least one ionic liquid.
2. A process according to claim 1, wherein the ionic liquid comprises a cation selected from the group consisting of formulae (Ia) to (Iw),



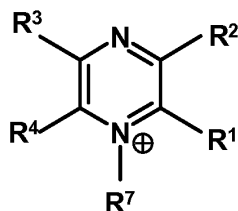
(a)



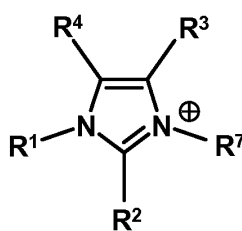
(b)



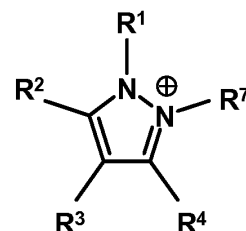
(c)



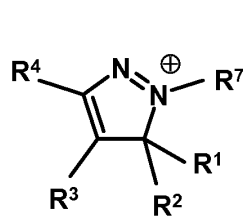
(d)



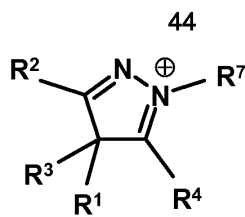
(e)



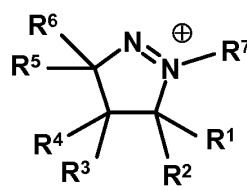
(f)



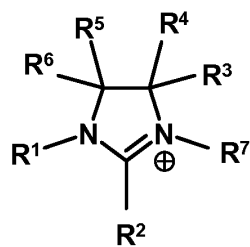
(g)



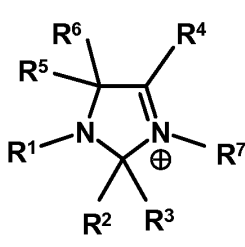
(h)



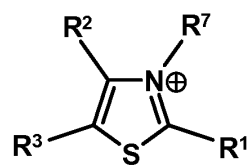
(i)



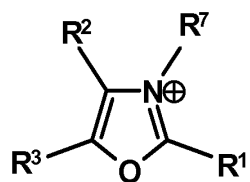
(m)



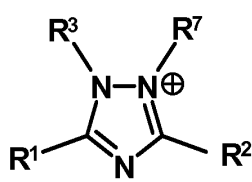
(n)



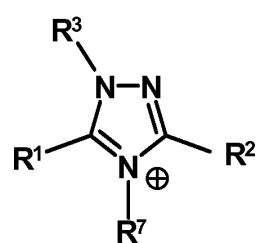
(o)



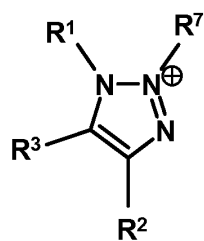
(p)



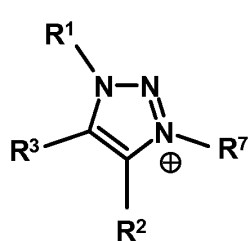
(q)



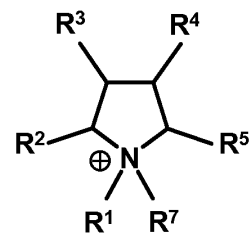
(r)



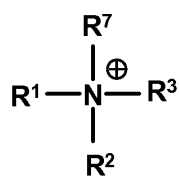
(s)



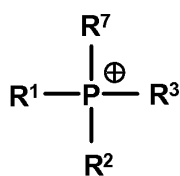
(t)



(u)



(v)

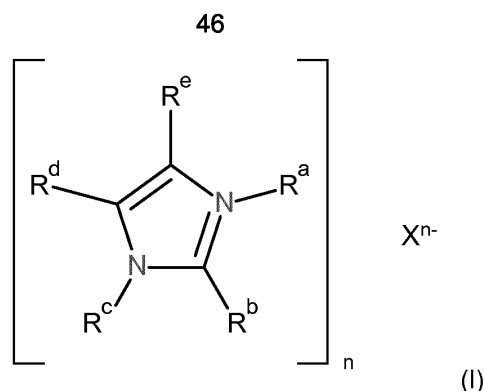


(w)

and oligomers and polymers in which these structures are present,

where

- 5 R^1 , R^2 , R^3 , R^4 , R^5 , R^6 and R^7 are each, independently of one another, C_1 – C_{18} -alkyl, C_2 – C_{18} -alkyl interrupted by one or more oxygen and/or sulfur atoms and/or one or more substituted or unsubstituted imino groups, C_6 – C_{12} -aryl, C_5 – C_{12} -cycloalkyl or a five- or six-membered, oxygen-, nitrogen- and/or sulfur-containing heterocycle or two of them together form an unsaturated, saturated or aromatic ring which may be interrupted by one or more oxygen
10 and/or sulfur atoms and/or one or more substituted or unsubstituted imino groups, where the radicals mentioned may each be substituted by functional groups, aryl, alkyl, aryloxy, alkyloxy, halogen, heteroatoms and/or heterocycles.
3. A process according to claim 1 or 2, wherein the ionic liquid comprises an anion selected
15 from the group consisting of fluoride, chloride; bromide, iodide; thiocyanate; hexafluorophosphate; trifluoromethanesulfonate; methanesulfonate; carboxylates, especially formate, acetate, propionate, butyrate or benzoate; mandelate; nitrate; nitrite; trifluoroacetate; sulfate; hydrogensulfate; methylsulfate; ethylsulfate; 1-propylsulfate; 1-butylsulfate; 1-hexylsulfate; 1-octylsulfate; sulfite; hydrogensulfite; phosphate; dihydrogenphosphate; hydrogenphosphate;
20 C_1 – C_4 -dialkylphosphates; carbonate CO_3^{2-} ; hydrogencarbonate HCO_3^- ; propionate; tetrachloroaluminate; $Al_2Cl_7^-$; $Al_3Cl_{10}^-$; chlorozincate; chloroferrate; chlorocuprate $CuCl_2^-$, bis(trifluoromethylsulfonyl)imide; bis(pentafluoroethylsulfonyl)imide; bis(methylsulfonyl)imide; bis(p-tolylsulfonyl)imide; tris(trifluoromethylsulfonyl)methide; bis(pentafluoroethylsulfonyl)methide; p-tolylsulfonate; tetracarbonylcobaltate; di-
25 methyleneglycolmonomethylethersulfate; oleate; stearate; acrylate; methacrylate; maleate; hydrogencitrate; vinylphosphonate; bis(pentafluoroethyl)phosphinate; borates such as bis[salicylato(2-)]borate, bis[oxalato(2-)]borate, bis[1,2-benzenediolato(2-)-O,O']borate, tetracyanoborate or tetrafluoroborate; dicyanamide; tris(pentafluoroethyl)trifluorophosphate; tris(heptafluoropropyl)trifluorophosphate, cyclic arylphosphates such as pyrocatechol-
30 phosphate of the formula $(C_6H_4O_2)P(O)O^-$; and chlorocobaltate.
4. A process according to claim 1, wherein the ionic liquid is an imidazolium salt of the general formula (I)



in which

the variables R^a and R^c are each independently an organic radical having 1 to 3000 carbon atoms,

the variables R^b, R^d and R^e are each independently hydrogen or an organic radical having 1 to 3000 carbon atoms,

X is an anion and

n is the number 1, 2 or 3.

5. The process according to any of the preceeding claims, wherein isobutene or an isobutene-comprising monomer mixture is polymerized in the presence of an aluminum trihalide-donor complex, an alkylaluminum halide-donor complex, an iron trihalide-donor complex, a gallium trihalide-donor complex or a titanium tetrahalide-donor complex.
6. The process according to any the claims 1 to 4, wherein isobutene or an isobutene-comprising monomer mixture is polymerized in the presence of an aluminum trichloride-donor complex or an alkylaluminum halide-donor complex or an iron-trihalide donor complex effective as a polymerization catalyst.
7. The process according to any of the preceeding claims, wherein the at least one organic compound (II) is selected from the group consisting of organic compounds with at least one ether function, organic compounds with at least one carboxylic ester function, organic compounds with at least one aldehyde function, and organic compounds with at least one keto function.
8. The process according to claim 5 or 6, wherein the Lewis Acid-donor complex, preferably the aluminum trihalide-donor complex or alkylaluminum halide-donor complex or iron-trihalide donor complex comprises as compound (II) at least one organic compound with at least one ether function is a dihydrocarbyl ether of the general formula R⁸-O-R⁹ in which the variables R⁸ and R⁹ are each independently C₁- to C₂₀-alkyl radicals, C₁- to C₂₀-haloalkyl

radicals, C₅- to C₈-cycloalkyl radicals, C₆- to C₂₀-aryl radicals, C₆- to C₂₀-haloaryl radicals, or C₇- to C₂₀-arylalkyl radicals is used.

9. The process according to any of the preceeding claims, wherein the at least one organic compound with at least one ether function comprises at least one ether with at least one secondary or tertiary dihydrocarbyl group, or a halide-substituted hydrocarbyl group.
10. The process according to claim 1 or 2, wherein the at least one organic compound with at least one ether function is selected from the group consisting of diethyl ether, di-n-butyl ether, di-isopropyl ether, and di-n-propyl ether, and chloroethyl ethyl ether.
11. The process according to claim 4, wherein the variables R^a to R^e are each independently C₁- to C₂₀-alkyl groups and the variables R^b, R^d and R^e additionally each may be hydrogen.
12. The process according to claim 4, wherein the variables R^a and R^c are each independently C₁- to C₂₀-alkyl groups and the variables R^b, R^d and R^e are each hydrogen.
13. The process according to claim 4, wherein the variables R^a and R^c are selected from the group consisting of methyl, ethyl, n-propyl, isopropyl, n-butyl, tert-butyl, pentyl, n-hexyl, 2-methylpentyl, n-heptyl, n-octyl, 2-ethylhexyl, n-decyl, n-dodecyl, tallow fatty alkyl radicals, and n-eicosyl.
14. The process according to any of claims 2, 3 or 4, wherein the anion X is selected from the group consisting of sulfate, an alkylsulfate, an alkylsulfonate, an alkylcarbonate, a halide, a pseudohalide, a carboxylate, a phosphate, a phosphonate, nitrate, nitrite, the TFSI anion of the formula N(SO₂CF₃)₂⁻, and the tricyanomethanide anion.
15. The process according to any of the preceeding claims, wherein the molar ratio of the aluminum trihalide or alkylaluminum halide to the isobutene monomer used in the case of homopolymerization of isobutene, or to the total amount of the polymerizable monomers used in the case of copolymerization of isobutene, based on each individual functional site of the aluminum trihalide or alkylaluminum halide, is from 0.001:1 to 0.2:1.
16. The process according to any of the preceeding claims, wherein the polymerization is performed with additional use of a mono- or polyfunctional initiator which is selected from organic hydroxyl compounds in which one or more hydroxyl groups are each bonded to an sp³-hybridized carbon atom, organic halogen compounds in which one or more halogen atoms are each bonded to an sp³-hybridized carbon atom and water.
17. The process according to claim 14, wherein the initiator is selected from water, methanol, ethanol, 1-phenylethanol, 1-(p-methoxyphenyl)ethanol, n-propanol, isopropanol, 2-phenyl-2-propanol, n-butanol, isobutanol, sec.-butanol, tert-butanol, 1-phenyl-1-chloroethane, 2-

phenyl-2-chloropropane, tert-butyl chloride and 1,3- or 1,4-bis(1-hydroxy-1-methylethyl)benzene.

- 5 18. The process according to claim 14 or 15, wherein the molar ratio of the initiators mentioned to the isobutene monomer used in the case of homopolymerization of isobutene, or to the total amount of the polymerizable monomers used in the case of copolymerization of isobutene, based on each individual functional site of the initiator, is from 0.0005:1 to 0.1:1, or when water is used as the sole initiator or in combination with organic hydroxyl compounds and/or organic halogen compounds as further initiators, the molar ratio of water to the isobutene monomer used in the case of homopolymerization of isobutene, or to the total amount of the polymerizable monomers used in the case of copolymerization of isobutene, is from 0.0001:1 to 0.1:1.
- 10
- 15 19. The process according to any of the preceding claims, wherein the polymerization is performed at a temperature of -90°C to +30°C.
- 20 20. The process according to any of the preceding claims, wherein the Lewis Acid-donor complex, preferably the aluminium trihalide-donor complex or the alkylaluminum halide complex or iron trihalide-donor complex is dispersed in an inert solvent prior to polymerization.