Claims

1. Process for the preparation of polyether carbonate polyols from one or more H-functional starter substances, one or more alkylene oxides and carbon dioxide in the presence of at least one double metal cyanide catalyst, wherein the cyanide-free metal salt, the metal cyanide salt or both the mentioned salts used for the preparation of the double metal cyanide catalyst contain(s) from 0.3 to 1.8 mol base equivalents (based on 1 mol of the metal cyanide salt used for the synthesis of the catalyst) of alkaline metal hydroxide, metal carbonate and/or metal oxide, characterized in that the DMC catalyst is prepared by reacting an aqueous solution of a cyanide-free metal salt with the aqueous solution of potassium hexacyanocobaltate(III)in the presence of one or more organic complex ligands, wherein one or more alkaline metal hydroxides, metal carbonates and/or metal oxides are present either in the aqueous solution of the cyanide-free metal salt, in the aqueous solution of potassium hexacyanocobaltate(III)or in both the aqueous solutions, and wherein the sum of the alkaline metal hydroxides, metal carbonates and/or metal oxides used is from 0.3 to 1.8 mol base equivalents (based on 1 mol of the potassium hexacyanocobaltate(III)used for the synthesis of the catalyst).

2. Process according to claim 1, wherein the DMC catalyst is prepared by
   (i) in the first step, reacting an aqueous solution of a cyanide-free metal salt with the aqueous solution of potassium hexacyanocobaltate(III)in the presence of one or more organic complex ligands, wherein one or more alkaline metal hydroxides and/or metal carbonates and/or metal oxides are present either in the aqueous solution of the cyanide-free metal salt, in the aqueous solution of potassium hexacyanocobaltate(III)or in both the aqueous solutions, and wherein the sum of the alkaline metal hydroxides and/or metal carbonates and/or metal oxides used is from 0.3 to 1.8 mol base equivalents (based on 1 mol of the metal cyanide salt used for the synthesis of the catalyst),
   (ii) wherein in the second step the solid is separated from the suspension obtained from (i),
   (iii) wherein in a third step the isolated solid is washed with an aqueous solution of an organic complex ligand,
   (iv) wherein the resulting solid is then dried,

   and wherein in the first step or immediately after the precipitation of the double metal cyanide compound (second step), one or more organic complex ligands are added.

3. Process according to any one of claims 1 or 2, wherein the cyanide-free metal salt, the potassium hexacyanocobaltate(III)or both the mentioned salts used for the preparation of the

double metal cyanide catalyst contain(s) from 0.6 to 1.6 mol base equivalents (based on 1 mol of potassium hexacyanocobaltate(III)used for the synthesis of the catalyst) in the form of an alkaline metal hydroxide, metal carbonate and/or metal oxide.

4. Process according to any one of claims 1 to 3, wherein the alkaline metal hydroxide, metal carbonate and/or metal oxide used is selected from at least one of the group consisting of the oxides or hydroxides of metals of groups 1a and 2a of the periodic system of the elements.

5. Process according to claim 4, wherein the alkaline metal hydroxide, metal oxide and/or metal carbonate used is selected from at least one of the group consisting of sodium carbonate, sodium hydroxide, potassium hydroxide, potassium carbonate, calcium oxide, calcium hydroxide, barium hydroxide and barium oxide.

6. Process according to claim 1 or 2, wherein the cyanide-free metal salt used to form the DMC compound is selected from at least one of the group consisting of zinc chloride, zinc bromide, zinc iodide, zinc acetate, zinc acetylacetonate, zinc benzoate, zinc nitrate, iron(II) sulfate, iron(II) bromide, iron(II) chloride, cobalt(II) chloride, cobalt(II) thiocyanate, nickel(II) chloride and nickel(II) nitrate.

7. Process according to any one of claims 1 to 6, characterised in that

   (α) the H-functional starter substance, or a mixture of at least two H-functional starter substances, is placed in a reaction vessel and optionally water and/or other readily volatile compounds are removed by elevated temperature and/or reduced pressure ("drying"), wherein the DMC catalyst is added to the H-functional starter substance, or the mixture of at least two H-functional starter substances, before or after the drying,

   (β) for activation

   (β1) in a first activation step, a first partial amount (based on the total amount of the amount of alkylene oxides used in the activation and copolymerisation) of one or more alkylene oxides is added to the mixture resulting from step (α), and wherein a waiting period is then observed until the temperature peak ("hotspot") that occurs as a result of the subsequent exothermic chemical reaction, and/or a pressure drop in the reactor occurs,

   (β2) in a second activation step, after the temperature peak reached in the preceding activation step, a second partial amount (based on the total amount of the amount of alkylene oxides used in the activation and copolymerisation) of one or more alkylene oxides is added to the mixture resulting from the preceding activation step, and wherein a

waiting period is then observed until the temperature peak ("hotspot") that occurs as a result of the subsequent exothermic chemical reaction, and/or a pressure drop in the reactor occurs,

(γ) one or more alkylene oxides and carbon dioxide are added to the mixture resulting from step (β) ("copolymerisation").

8. Process according to any one of claims 1 to 7, characterised in that the copolymerisation of alkylene oxides and carbon dioxide takes place under a pressure of from 1 to 200 bar.

9. Process according to any one of claims 1 to 8, characterised in that the copolymerisation of alkylene oxides and carbon dioxide (step γ)) takes place in the temperature range from 60 to 150°C.

10. Process according to any one of claims 1 to 9, which is carried out in a tubular reactor, stirrer vessel or loop reactor.

11. Process according to any one of claims 1 to 10 carried out in a stirrer vessel, characterised in that in step γ) one or more H-functional starter compounds are metered continuously into the reactor during the reaction.

CLAIMS

1. A process for preparing a polyether carbonate polyol consisting of reacting one or more H-functional starter substances, one or more alkylene oxides, and carbon dioxide in the presence of at least one double metal cyanide catalyst prepared from a cyanide-free metal salt and a potassium hexacyanocobaltate(III) salt, wherein said cyanide-free metal salt and/or said potassium hexacyanocobaltate(III) salt comprises from 0.3 to 1.8 mol base equivalents, based on 1 mol of said metal cyanide salt, of an alkaline metal hydroxide, metal carbonate, and/or metal oxide, wherein said at least one double metal cyanide catalyst is prepared by reacting an aqueous solution of said cyanide-free metal salt with an aqueous solution of said potassium hexacyanocobaltate(III) salt in the presence of one or more organic complex ligands, wherein said aqueous solution of said cyanide-free metal salt and/or said aqueous solution of said potassium hexacyanocobaltate(III) salt comprises one or more alkaline metal hydroxides, metal carbonates, and/or metal oxides, and wherein the total amount of said one or more alkaline metal hydroxides, metal carbonates, and/or metal oxides used is in the range of from 0.3 to 1.8 mol base equivalents, based on 1 mol of the potassium hexacyanocobaltate(III) salt.

2. The process of claim 1, wherein said at least one double metal cyanide catalyst is prepared by

   (i) reacting an aqueous solution of said cyanide-free metal salt with an aqueous solution of said potassium hexacyanocobaltate(III) salt in the presence of one or more organic complex ligands, wherein said aqueous solution of said cyanide-free metal salt and/or said aqueous solution of said potassium hexacyanocobaltate(III) salt comprises one or more alkaline metal hydroxides and/or metal carbonates and/or metal oxides, and wherein the total amount of said one or more alkaline metal hydroxides and/or metal carbonates and/or metal oxides used is in the range of from 0.3 to 1.8 mol base equivalents, based on 1 mol of the potassium hexacyanocobaltate(III) salt, to obtain a suspension;

   (ii) separating the solid from the suspension obtained in step (i);

(iii) washing the solid of step (ii) with an aqueous solution of an organic complex ligand;

(iv) drying the solid of step (iii);

wherein one or more organic complex ligands are added in step (i) or immediately after step (ii).

3. The process of claim 1, wherein said cyanide-free metal salt and/or said potassium hexacyanocobaltate(III) salt comprise from 0.6 to 1.6 mol base equivalents, based on 1 mol of the potassium hexacyanocobaltate(III) salt, of an alkaline metal hydroxide, metal carbonate, and/or metal oxide.

4. The process of claim 1, wherein said alkaline metal hydroxide, metal carbonate, and/or metal oxide is selected from the group consisting of the oxides of metals of groups 1a and 2a of the periodic table of the elements, hydroxides of metals of groups 1a and 2a of the periodic table of the elements, and mixtures thereof.

5. The process of claim 4, wherein said alkaline metal hydroxide, metal oxide, and/or metal carbonate is selected from the group consisting of sodium carbonate, sodium hydroxide, potassium hydroxide, potassium carbonate, calcium oxide, calcium hydroxide, barium hydroxide, barium oxide, and mixtures thereof.

6. The process of claim 1, wherein said cyanide-free metal salt is selected from the group consisting of zinc chloride, zinc bromide, zinc iodide, zinc acetate, zinc acetylacetonate, zinc benzoate, zinc nitrate, iron(II) sulfate, iron(II) bromide, iron(II) chloride, cobalt(II) chloride, cobalt(II) thiocyanate, nickel(II) chloride, nickel(II) nitrate, and mixtures thereof.

7. The process of claim 1, wherein

(a) said one or more H-functional starter substances and said at least one double metal cyanide catalyst is placed in a reaction vessel and optionally dried by the removal of water and/or other readily volatile compounds via elevated temperature and/or reduced pressure to obtain a mixture, wherein said at least

one double metal cyanide catalyst is added to said H-functional starter substance before or after drying;

(b1) in a first activation step, adding a first partial amount, based on the total amount of alkylene oxides used in the activation and copolymerisation, of one or more alkylene oxides to the mixture obtained in step (a) and observing a waiting period until a temperature peak occurs as a result of the subsequent exothermic chemical reaction and/or a pressure drop in the reactor to obtain a mixture;

(b2) in a second activation step, after the temperature peak reached in step (b1), adding a second partial amount, based on the total amount of alkylene oxides used in the activation and copolymerisation, of one or more alkylene oxides to the mixture obtained in step (b1) and observing a waiting period until a temperature peak occurs as a result of the subsequent exothermic chemical reaction and/or a pressure drop in the reactor to obtain a mixture; and

(c) adding one or more alkylene oxides and carbon dioxide to the mixture obtained in step (b2).

8. The process of claim 7, wherein the reaction of said alkylene oxides and carbon dioxide takes place under a pressure of from 1 to 200 bar.

9. The process of claim 7, wherein the reaction of said alkylene oxides and carbon dioxide takes place at a temperature in the range of from 60 to 150° C.

10. The process of claim 7, wherein said process is carried out in a tubular reactor, stirrer vessel, or loop reactor.

11. The process of claim 7, wherein said process is carried out in a stirrer vessel and wherein in step c) one or more H-functional starter compounds are metered continuously into the reactor during the reaction.