Claims

1. A process for preparing 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 or metal cyanide salt used for preparation of the double metal cyanide catalyst, or both of these salts, contain(s) 0.3 to 1.8 mol of base equivalents (based on 1 mol of the metal cyanide salt used for catalyst synthesis) of alkaline metal hydroxide, metal carbonate and/or metal oxide.

2. The process as claimed in claim 1, characterized in that the DMC catalyst is prepared by reacting an aqueous solution of a cyanide-free metal salt with the aqueous solution of a metal cyanide salt in the presence of one or more organic complex ligands, one or more alkaline metal hydroxides, metal carbonates and/or metal oxides being present either in the aqueous solution of the cyanide-free metal salt or the aqueous solution of the metal cyanide salt, or in both aqueous solutions, and the sum of the alkaline metal hydroxides, metal carbonates and/or metal oxides used being 0.3 to 1.8 mol of base equivalents (based on 1 mol of the metal cyanide salt used for catalyst synthesis).

3. The process as claimed in 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 a metal cyanide salt in the presence of one or more organic complex ligands, one or more alkaline metal hydroxides and/or metal carbonates and/or metal oxides being present either in the aqueous solution of the cyanide-free metal salt or the aqueous solution of the metal cyanide salt, or in both aqueous solutions, and the sum of the alkaline metal hydroxides and/or metal carbonates and/or metal oxides used being 0.3 to 1.8 mol of base equivalents (based on 1 mol of the metal cyanide salt used for catalyst synthesis),
   (ii) in the second step, removing the solids from the suspension obtained from (i),

(iii) in a third step, washing the isolated solids with an aqueous solution of an organic complex ligand,

(iv) then drying the resulting solids,

and, 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.

4. The process as claimed in any of claims 1 to 3, wherein the cyanide-free metal salt or metal cyanide salt used for preparation of the double metal cyanide catalyst contains, or both of these salts contain, 0.6 to 1.6 mol of base equivalents (based on 1 mol of the metal cyanide salt used for catalyst synthesis) in the form of an alkaline metal hydroxide, metal carbonate and/or metal oxide.

5. The process as claimed in any of claims 1 to 4, 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 Table of the Elements.

6. The process as claimed in claim 5, 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.

7. The process as claimed in claim 2 or 3, wherein the cyanide-free metal salt used for formation of 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.

8. The process as claimed in claim 2 or 3, wherein the metal cyanide salt used is

selected from at least one of the group consisting of potassium hexacyanocobaltate(III), potassium hexacyanoferrate(II), potassium hexacyanoferrate(III), calcium hexacyanocobaltate(III) and lithium hexacyanocobaltate(III).

9. The process as claimed in any of claims 1 to 8, characterized in that

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

(β) activation is accomplished by

(β1) in a first activation step, adding a first portion (based on the total amount of the amount of alkylene oxides used in the activation and copolymerization) of one or more alkylene oxides to the mixture resulting from step (α), and in each case awaiting the temperature peak ("hotspot") which occurs due to the exothermic chemical reaction which follows and/or a pressure drop in the reactor,

(β2) in a second activation step, after the temperature peak attained in the preceding activation step, adding a second portion (based on the total amount of the amount of alkylene oxides used in the activation and copolymerization) of one or more alkylene oxides to the mixture resulting from the preceding activation step, and in each case awaiting the temperature peak ("hotspot") which occurs due to the exothermic chemical reaction which follows and/or a pressure drop in the reactor,

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

10. The process as claimed in any of claims 1 to 9, characterized in that the copolymerization of alkylene oxides and carbon dioxide is effected under a pressure of 1 to 200 bar.

11. The process as claimed in any of claims 1 to 10, characterized in that the copolymerization of alkylene oxides and carbon dioxide (step (γ)) is effected within the temperature range from 60 to 150°C.

12. The process as claimed in any of claims 1 to 11, which is performed in a tubular reactor, stirred tank or loop reactor.

13. The process as claimed in any of claims 1 to 11 performed in a stirred tank, characterized in that, in step γ), one or more H-functional starter compounds are metered continuously into the reactor during the reaction.

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.