Claims

1. Catalyst particle for the oxidative esterification of an aldehyde to a carboxylic ester, wherein the particle comprises the elements oxygen, silicon, aluminium, a basic element, gold, cobalt and optionally at least one element selected from iron and zinc, and wherein the maximum gold concentration and the maximum iron, zinc and/or cobalt concentration of the catalyst particle in an outer region which makes up a maximum of 60% of the geometric equivalent diameter is at least 1.5 times as high as the gold concentration and iron, zinc or cobalt concentration in the middle region which makes up the remaining region of the geometric equivalent diameter.

2. Catalyst particle according to Claim 1, wherein the basic element is an alkali metal, an alkaline earth metal, a rare earth metal or a mixture of these metals.

3. Catalyst particle according to at least one of Claims 1 to 2, wherein the catalyst particle contains, based on the total molar amount of gold, silicon, aluminium, basic element, cobalt and optionally iron and/or zinc, 0.03 to 3 mol% of gold, 40 to 90 mol% of silicon, 3 to 40 mol% of aluminium, 2 to 40 mol% of the basic element and 0.1 to 20 mol% of cobalt and optionally iron and/or zinc, where the molar ratio of cobalt and optionally iron and/or zinc to gold is between 0.1 and 20 and all these elements except for the gold are present in the form of oxides.

4. Catalyst particle according to at least one of Claims 1 to 3, wherein the catalyst particle has a mean geometric equivalent diameter between 10 and 250 µm, and wherein the thickness of the outer region is between 2 and 100 µm.

5. Catalyst particle according to at least one of Claims 1 to 4, wherein the gold- and cobalt oxide-containing particles and optionally iron- and/or zinc-oxide containing particles having a mean diameter between 2 and 10 nm are present in the outer region of the catalyst particle.

6. Catalyst particle according to at least one of Claims 1 to 5, wherein the particles are porous and have a specific surface area between 100 and 300 m^2/g, and wherein the average pore diameter thereof is 1 to 50 nm.

7. Catalyst particle according to Claim 6, wherein the specific surface area of the catalyst particle is between 150 and 250 m^2/g, and wherein the average pore diameter is 2 to 20 nm.

8. Process for producing a catalyst particle according to at least one of Claims 1 to 7, having the following steps:

1) applying a cobalt compound and optionally at least one iron and/or zinc compound to a particle consisting of the oxides of silicon, of aluminium and of one or more alkali metals, alkaline earth metals or rare earth metals,

2) partly or fully oxidizing the material from 1) and optionally drying/calcining,

3) applying at least one gold compound to the material from step 2) and

4) drying and/or calcining the material from step 3).

9. Process according to Claim 8, wherein process step 2 comprises heating in the presence of oxygen or the addition of an oxidizing agent, especially of H_2O_2, to an aqueous suspension of the particle from process step 1.

10. Process according to Claim 9, wherein process step 2 is a calcination in the presence of oxygen.

11. Process according to at least one of Claims 8 to 10, wherein the particle comprising the oxides of silicon, of aluminium and optionally of one or more alkali metals, alkaline earth metals or rare earth metals goes through at least one thermal treatment with water within process steps 1 to 3, the water temperature being between 50 and 100°C.

12. Process according to at least one of Claims 8 to 11, wherein process steps 1, 3 and optionally 2 are conducted in an aqueous medium, and wherein process steps 1 and 3 are effected using a water-soluble cobalt compound or water-soluble gold compound.

13. Process according to Claim 11, wherein the water temperature is between 70 and 95°C.

14. Process according to at least one of Claims 8 to 13, wherein, in process step 3, first a basic solution and then a solution comprising auric acid, having a pH between 0.5 and 5, are added to an aqueous suspension of the particles from process step 2.

15. Process according to at least one of Claims 8 to 13, wherein, in process step 3, a solution which has been obtained by the partial or complete neutralization of an auric acid solution, having a pH between 0.5 and 5, with a base, preferably with an NaOH solution, is added to an aqueous suspension of the particles from process step 2.

16. Use of a catalyst particle according to at least one of Claims 1 to 7 for oxidative esterification of an aldehyde in the presence of oxygen and an alcohol to give a carboxylic ester.

17. Use of a catalyst particle according to Claim 16 for oxidative esterification of methacrolein in the presence of oxygen and an alcohol to give an alkyl methacrylate.