CLAIMS

1. A catalyst for producing isopropylbenzene from α,α-dimethylbenzyl alcohol, comprising a support and an active component supported on the support, wherein the support comprises a support substrate and a modifying auxiliary component supported on the support substrate, wherein,
the active component includes metal palladium and/or oxides thereof,
the modifying auxiliary component includes phosphorus and/or oxides thereof,
wherein the support substrate is not silica, and said modifying auxiliary component further includes silica, wherein the molar ratio of the silicon to phosphorus based on the element is ≤ 20.

2. The catalyst according to claim 1, characterized in that the content of the metal palladium and/or oxides thereof in the catalyst is 0.01-5wt%, preferably 0.05-1wt%, based on the content of the element palladium, and/or the metal palladium has a dispersity of 5-10%, preferably 6.5-8.5%.

3. The catalyst according to claim 2, characterized in that the active component further includes an active auxiliary metal and/or oxides thereof; preferably, the active auxiliary metal is at least one selected from the group consisting of metal copper, metal zinc, metal cobalt, metal tin, metal nickel and metal silver;
preferably, the content of the active auxiliary metal and/or oxides thereof in the catalyst is 0.0001-0.2wt%, more preferably 0.0007-0.2wt%, based on the content of the auxiliary metal element therein.

4. The catalyst according to any one of claims 1 to 3, characterized in that the content of the modifying auxiliary component in the catalyst is 0.2-20wt%, preferably 1-15wt%, based on the content of element phosphorus.

5. The catalyst according to any one of claims 1 to 4, characterized in that, the support substrate is at least one selected from the group consisting of alumina and activated carbon, and/or
the support substrate has a pore size of 10-25nm and a specific surface area of 50-180m^2/g.

6. The catalyst according to any one of claims 1 to 5, characterized in that, the catalyst further includes a co-catalyst; preferably, the co-catalyst is a sulfur-containing compound; more preferably, the sulfur-containing compound is derived from a sulfur-containing organic matter; further preferably, the sulfur-containing organic matter is at least one selected from the group of tert-nonyl polysulfides, tert-butyl polysulfides, thiophenes and dimethyl disulfides etc.;
the content of the co-catalyst in the catalyst is preferably >0-1wt%, more preferably >0-0.8wt%, wherein the amount of the co-catalyst is based on the amount of effective elements therein, for example, the amount of element sulfur.

7. The catalyst according to any one of claims 1 to 6, characterized in that, the silica is derived from silica gel, and
the content of silica in the catalyst is preferably >0-60wt%, more preferably >0-40wt%.

8. The catalyst according to any one of claims 1 to 7, characterized in that, the molar ratio of the silicon to phosphorus based on the element is ≤10, preferably ≤4, wherein, the content of the modifying auxiliary component phosphorus and/or oxides thereof in the catalyst is 0.2-20wt%, preferably 1-15wt%, more preferably 1-7wt%, wherein the content of phosphorus and/or oxides thereof is based on the content of element phosphorus therein, and the silica content in the catalyst is >0-60wt%, preferably >0-40wt%, for example, >0-20wt%.

9. A method for producing the catalyst according to any one of claims 1 to 8, comprising the following steps:

Step 1: an aqueous solution of a phosphorus-containing compound is mixed with a support substrate, dried and calcined to obtain a phosphorus-containing support;

Step 1': the phosphorus-containing support is mixed with an aqueous solution of silica gel, dried and calcined to obtain a support containing phosphorus and silicon;

Step 2: the support containing phosphorus and silicon is added to a solution of a palladium-containing compound, dried and calcined to obtain a catalyst precursor in an oxidized state;

Step 3: the catalyst precursor in an oxidized state is subjected to a reduction treatment to obtain a catalyst.

10. The production method according to claim 9, characterized in that,

the support substrate is at least one selected from the group consisting of alumina and activated carbon, and/or

the palladium-containing compound is at least one selected from the group consisting of palladium chloride, palladium nitrate and chloropalladic acid, and/or

the phosphorus-containing compound is at least one selected from the group consisting of phosphoric acid, potassium dihydrogen phosphate, phosphorous acid, calcium phosphate and ammonium hydrogen phosphate, etc., and/or

the solution in step 2 further comprises a compound containing an active auxiliary metal which is preferably at least one selected from the group consisting of active auxiliary metal chlorides, compounds of active auxiliary metal nitrates and compounds of active auxiliary metal acetates; more preferably, the active auxiliary metal is at least one selected from the group consisting of metal copper, metal zinc, metal cobalt, metal tin, metal nickel

and metal silver.

11. The production method according to either of claims 9 to 10, characterized in that,
in step 1, step 2, the calcining temperature is 400-700°C, preferably 400-500°C, and/or
in step 3, a reduction treatment is carried out with hydrogen; preferably, the reduction temperature is 40-300°C, preferably 200-300°C, more preferably 250°C; the volume space velocity of hydrogen is 50-500h^{-1}, preferably 80-150h^{-1}.

12. The production method according to any one of claims 9 to 11, characterized in that the method further comprises step 4:
Step 4: the catalyst according to step 3 is added to a co-catalyst-containing solution and dried to obtain a further catalyst;
preferably, the co-catalyst is a sulfur-containing compound; more preferably, the sulfur-containing compound is derived from a sulfur-containing organic matter; further preferably, the sulfur-containing organic matter is at least one selected from the group of tert-nonyl polysulfides, tert-butyl polysulfides, thiophenes and dimethyl disulfides.

13. The production method according to any one of claims 9 to 12, characterized in that, based on 1L of the support substrate,
the amount of the palladium-containing compound is 0.06g/L-30g/L, preferably 0.5g/L-10g/L, based on the amount of element palladium therein, and/or
the amount of the compound containing an active auxiliary metal is 0.0006g/L-1.2g/L, preferably 0.01g/L-1.0g/L, based on the amount of the element of the active auxiliary metal therein, and/or
the amount of the phosphorus-containing compound is 2g/L-100g/L, preferably 5g/L-80g/L, based on the amount of element phosphorus therein,

and/or

the amount of the co-catalyst is 0.0001g/L-3g/L, preferably 0.01g/L-1g/L, more preferably 0.05g/L-0.2 g/L, wherein the amount of the co-catalyst is based on the amount of effective elements therein, such as element sulfur, and/or

the amount of silica gel is 6-300g/L, preferably 20-200g/L, wherein the amount of silica gel is based on the amount of silica therein.

14. The use of the catalyst according to any one of claims 1 to 8 or the catalyst obtained by the method according to any one of claims 9 to 13 in the production of isopropylbenzene from α,α-dimethylbenzyl alcohol.

15. A method for producing isopropylbenzene from α,α-dimethylbenzyl alcohol, which is carried out in the presence of the catalyst according to any one of claims 1 to 8 or the catalyst obtained by the method according to any one of claims 9 to 13; more preferably, the production method comprises: bring raw material in contact with hydrogen to react in the presence of the catalyst to obtain isopropylbenzene, wherein the method preferably employs a liquid phase thermal cycle process; more preferably, the cycle ratio is 1-10, preferably 4-8.

16. The production method according to claim 15, characterized in that the raw material comprise a hydrocarbon material comprising α,α-dimethylbenzyl alcohol, wherein the hydrocarbon material optionally comprises isopropylbenzene, acetophenone, α-methylstyrene and dimerized isopropyl benzene, and optionally comprises isopropylbenzene hydroperoxide; preferably, the hydrocarbon material comprising α,α-dimethylbenzyl alcohol comprises an inert solvent, preferably isopropylbenzene and α,α-dimethylbenzyl alcohol.

17. The production method according to claim 16, characterized in that a

pressure is 0.1-4.0MPa, a temperature is 130-220°C, a liquid hourly space velocity is 1-20 h^{-1}, and a molar ratio of hydrogen to α,α-dimethylbenzyl alcohol is > 4 in the production method;

preferably, the pressure is 0.5-3.0MPa, the temperature is 150-200°C, the liquid hourly space velocity is 4-15 h^{-1}, and the molar ratio of hydrogen to α,α-dimethylbenzyl alcohol is > 5.

18. A method to produce isopropylbenzene from α,α-dimethylbenzyl alcohol, comprising obtaining the isopropylbenzene from raw material of a hydrocarbon material comprising α,α-dimethylbenzyl alcohol and hydrogen through a first catalyst bed and a second catalyst bed in series, preferably by a liquid phase thermal cycle process;

wherein,

the catalyst loading of the first catalyst bed is greater than or equal to that of the second catalyst bed; preferably, the ratio by volume of the catalyst loading of the first catalyst bed to the catalyst loading of the second catalyst bed is (1-6): 1, preferably (2-4): 1;

the inlet temperature of the first catalyst bed is not higher than the inlet temperature of the second catalyst bed; preferably the first catalyst bed has a reaction temperature of 130-190°C, a reaction pressure of 0.1-5MPa, and a liquid hourly space velocity of 1.0-20h^{-1}, and/or the second catalyst bed has a reaction temperature of 150-230°C, a reaction pressure of 0.1-5 MPa, and a liquid phase volume space velocity of 2.0-10h^{-1},

the liquid phase thermal cycle ratio of the first catalyst bed is preferably 1-10;

the liquid phase thermal cycle ratio of the second catalyst bed is preferably 0-2.

19. The production method according to claim 18, wherein, in the first catalyst bed, the ratio by volume of hydrogen to the liquid phase is 300-1000, preferably 400-800, and/or in the second catalyst bed, the ratio by volume of

hydrogen to the liquid phase is 100-800, preferably 200-400.

20. The production method according to claims 18-19, wherein,
the catalyst of the first catalyst bed comprises metal Pd and/or oxides, and a support, and/or the catalyst of the second catalyst bed comprises metal Pd and/or oxides, a metal auxiliary and/or oxides thereof, and a support; preferably, the metal auxiliary is at least one selected from the group consisting of Fe, Co, Ni, Ca, Mg and Cu, more preferably at least one selected from the group consisting of Cu, Ni and Mg, or
the catalyst of the first catalyst bed and/or the catalyst of the second catalyst bed are the catalysts according to any one of claims 1 to 8.

21. The use of the method according to any one of claims 15-20 in the production of propylene oxide.