Claims

1. A ~~binderless~~ molecular sieve catalyst, comprising, based on the weight of the catalyst, 90-100 wt.% of a molecular sieve, 0-10 wt.% of a binder, and 0-10 wt.% of an anti-wear agent, wherein said catalyst has a pore volume of 0.10-0.52 ml/g, an average pore diameter of 50-100 nm, and a porosity of 20-40%; the anti-wear agent is selected from the rod or needle-like inorganic materials having a length/diameter ratio of 2-20.

2. The ~~binderless~~ molecular sieve catalyst according to claim 1, characterized in that the catalyst has a pore volume of 0.15-0.3 ml/g, an average pore diameter of 50-70 mm, and a porosity of 20-30%.

3. The ~~binderless~~ molecular sieve catalyst according to claim 1, characterized in that the catalyst has a pore volume of 0.31-0.5 ml/g, an average pore diameter of 71-100 nm, and a porosity of 31-40%.

4. The ~~binderless~~ molecular sieve catalyst according to claim 1, characterized in that the molecular sieve in the ~~binderless~~ molecular sieve catalyst comprises at least one selected from the group consisting of ZSM-5, ZSM-23, ZSM-11, mordenite, Y zeolite, β zeolite, MCM-22, MCM-49, MCM-56, ZSM-5/mordenite, β zeolite/mordenite, ZSM-5/β zeolite, ZSM-5/Y, MCM-22/mordenite, ZSM-5/Magadiite, ZSM-5/β zeolite/mordenite, ZSM-5/β zeolite/Y zeolite and ZSM-5/Y zeolite/mordenite.

5. The ~~binderless~~ molecular sieve catalyst according to claim 1, characterized in that the anti-wear agent is at least one inorganic material selected from the group consisting of asbestos, ceramic fiber, glass fiber, and wollastonite mineral, wherein the anti-wear agent has an average length of 1-100 μm and a length/diameter ratio of 3-10 and is in an amount 2-10 wt.% based on the weight of the calcined end product of the catalyst.

6. A process for preparing a ~~binderless~~ molecular sieve catalyst according to claim 1, comprising the steps of

a) based on the weight of the molded and calcined catalyst, mixing 10-80 wt.% of a molecular sieve, 0.1-20 wt.% of an induction material, 0-20 wt.% of an aluminum compound and 10-80 wt.% of silica, molding and drying to obtain a molded catalyst precursor mix I, wherein the weight percent of the aluminum compound in the mix I is less than that of silica;

b) crystallizing the mix I at 100-200°C in water vapor or vapor of a template ~~vapor~~ for 10-300 h, to obtain a ~~binderless~~ molecular sieve catalyst precursor; and

c) drying the catalyst precursor, and calcining at 400-700°C for 1-10 h to obtain a ~~binderless~~ molecular sieve catalyst;

wherein the induction material is at least one selected from the group consisting of i) oxides or hydroxides of the elements of Group IA or IIA of the Periodic Table of Elements, or salts of weak acids thereof, ii) carbonates, bicarbonates, oxalates, or citrates of the elements of Group IA or IIA of the Periodic Table of Elements, ~~or~~ and iii) at least one ammonium salts; the aluminum compound is at least one selected from the group consisting of aluminum salts, aluminum oxides, hydrous oxides of aluminum and hydroxides of aluminum.

7. The process for preparing a ~~binderless~~ molecular sieve catalyst according to claim 6, characterized in that the template is at least one selected from the group consisting of ammonia, ethylene diamine, triethylamine, n-butylamine, hexanediamine, tetrapropylammonium bromide or tetrapropylammonium hydroxide, tetraethylammonium hydroxide, tetraethylammonium bromide and hexamethyleneimine, and is in an amount of 5-200 wt.% based on the weight of the mix I.

8. The process for preparing a ~~binderless~~ molecular sieve catalyst according to claim 6, characterized in that the element of Group IA is at least one selected from the group consisting of sodium and potassium; the element of Group IIA is at least one selected from the group consisting of magnesium and calcium.

9. The process for preparing a ~~binderless~~ molecular sieve catalyst according to claim 6, characterized in that the salt of weak acids is at least one selected from the group consisting of bisulphate, sulphite, hydrosulfite,

phosphate and biphosphate.

10. The process for preparing a ~~binderless~~ molecular sieve catalyst according to claim 6, characterized in that the ammonium salt is at least one selected from the group consisting of ammonium carbonate, ammonium bicarbonate, ammonium citrate, ammonium oxalate, ammonium sulphate, ammonium bisulphate, ammonium sulphite, ammonium bisulphite, ammonium phosphate, ammonium hydrogen phosphate and diammonium phosphate.

11. The process for preparing a ~~binderless~~ molecular sieve catalyst according to claim 6, characterized in that, based on the weight of the molded and calcined catalyst, the molecular sieve in step a) is in an amount of ~~20-70~~10-80 wt.%; the induction material is in an amount of 0.5-10 wt.%; the aluminum compound is in an amount of 1-15 wt.%; and silica is in an amount of ~~30-70~~10-80 wt.%.

12. The process for preparing a ~~binderless~~ molecular sieve catalyst according to claim 6, characterized in that the crystallization is carried out at 120-200°C for 20-200 h.

13. The process for preparing a ~~binderless~~ molecular sieve catalyst according to claim 6, characterized in that, during the molding process of step a), at least one pore-expanding agent selected from the group consisting of methyl cellulose, polyvinyl alcohol, sesbania powder, dissolvable starch and carbon nano-tube is added in an amount 0.1-2 wt.% based on the weight of the molded and calcined catalyst.

14. ~~The~~ A process for preparing a ~~binderless~~ molecular sieve catalyst according to claim 1, comprising the steps of

(a) homogeneously mixing a molecular sieve, a binder, a dispersant having an induction action, a liquid medium, an optional pore-expanding agent, an optional substrate material, and an optional anti-wear agent to form a suspension, wherein the dispersant is selected from the group consisting of i) salts of weak acids of the elements of Group IA or IIA of the Periodic Table of Elements, ~~or~~and ii) carbonates, bicarbonate, oxalates

and citrates of ammonium;

(b) high velocity shearing and diffusing to control the particle size of the materials in the suspension within 0.1-5 μm;

(c) spray-drying said suspension to form a microsphere catalyst precursor I;

(d) calcining such microsphere catalyst precursor I at 300-700°C for 1-10 h to obtain a catalyst precursor II;

(e) crystallizing the catalyst precursor II at 100-300°C in water vapor or ~~template~~ vapor of a template for 10-240 h, to obtain a catalyst precursor III; and

(f) calcining such microsphere catalyst precursor III at 400-700°C for 1-10 h to obtain a end product of the catalyst.

15. The process for preparing a ~~binderless~~ molecular sieve catalyst according to claim 6 or 14, characterized in that the molecular sieve is at least one selected from the group consisting of ZSM-5, ZSM-23, ZSM-11, mordenite, Y zeolite, β zeolite, MCM-22, MCM-49, MCM-56, ZSM-5/mordenite, ZSM-5/β zeolite, ZSM-5/Y, MCM-22/mordenite, ZSM-5/Magadiite, ZSM-5/β zeolite/mordenite, ZSM-5/β zeolite/Y zeolite and ZSM-5/Y zeolite/mordenite, and is in an amount of 10-80 wt.% based on the weight of the molded and calcined catalyst.

16. The process for preparing a ~~binderless~~ molecular sieve catalyst according to claim 14, characterized in that the binder is at least one selected from silicasol and aluminum sol, and is in an amount of 2-70 wt.% based on the weight of the calcined end product of the catalyst.

17. The process for preparing a ~~binderless~~ molecular sieve catalyst according to claim 14, characterized in that the substrate material is at least one selected from the group consisting of kaolin, calcined kaolin, diatomite, bentonite, argil and clay, and is in an amount of 0-50 wt.% based on the weight of the calcined end product of the catalyst.

18. The process for preparing a ~~binderless~~ molecular sieve catalyst according to claim 14, characterized in that the pore-expanding agent is at least one selected from the group consisting of methyl cellulose, polyvinyl

alcohol, sesbania powder, dissolvable starch and carbon nano-tube, and is in an amount 0.1-5 wt.% based on the weight of the molecular sieve in the calcined end product of the catalyst.

19. The process for preparing a ~~binderless~~ molecular sieve catalyst according to claim 14, characterized in that the dispersant is at least one selected from the group consisting of tri-ammonium citrate, ammonium oxalate, ammonium carbonate and ammonium bicarbonate, and is in an amount 0.01-5 wt.% based on the weight of the molecular sieve in the calcined end product of the catalyst.

20. The process for preparing a ~~binderless~~ molecular sieve catalyst according to claim 14, characterized in that the anti-wear agent is at least one inorganic material selected from the group consisting of asbestos, ceramic fiber, glass fiber, and wollastonite mineral, wherein the anti-wear agent has an average length of 1-100 μm and a length/diameter ratio of 3-10 and is in an amount 2-10 wt.% based on the weight of the calcined end product of the catalyst.

21. The process for preparing a ~~binderless~~ molecular sieve catalyst according to claim 14, characterized in that the content of the suspension solids in step (a) ranges from 10-50 wt.%.

22. The process for preparing a ~~binderless~~ molecular sieve catalyst according to claim 14, characterized in that the particle size of the materials in step (b) is controlled to be 0.1-2 μm by using the high velocity shearing or cyclic emulsification method.

23. The process for preparing a ~~binderless~~ molecular sieve catalyst according to claim 14, characterized in that the spray-drying in step (c) is conducted under the conditions of an inlet temperature of 180-350°C, an outlet temperature of 100-180°C, a centrifugal rotational speed of 5,000-15,000 rpm, a cyclone pressure difference of 0.5-1.0 KPa at the outlet.

24. The process for preparing a ~~binderless~~ molecular sieve catalyst

according to claim 14, characterized in that, after the spray-dried catalyst is calcined at high temperature, the particles of the catalyst precursor II have an average particle size of 50-100 μm, a specific surface area of 100-310 m^2/g, an average pore diameter of 1-20 nm, a density of 0.6-1.2 g/ml and an abrasion index of 0.01-1.2 wt.%/h.

25. The process for preparing a ~~binderless~~ molecular sieve catalyst according to claim 14, characterized in that the template is at least one selected from the group consisting of ammonia, ethylene diamine, triethylamine, n-butylamine, hexanediamine, tetrapropylammonium bromide or tetrapropylammonium hydroxide, tetraethylammonium hydroxide, tetraethylammonium bromide and hexamethyleneimine, and is in an amount of 5-200 wt.% based on the weight of the molded and calcined catalyst precursor II.

26. The process for preparing a ~~binderless~~ molecular sieve catalyst according to claim 14, characterized in that the crystallization is carried out at 120-200°C for 20-200 h.