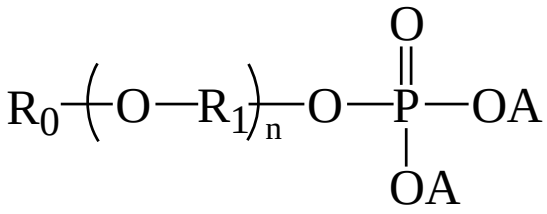
Claims

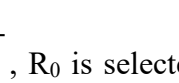
1. A pseudo-boehmite having a dry basis content of 55-85wt% and containing a phosphoric acid ester group, wherein the sodium oxide content is not greater than 0.5wt% , and the phosphorus content in terms of phosphorus pentoxide is 1.2-5.7wt%, relative to 100wt% of the total weight of the pseudo-boehmite.

2. The pseudo-boehmite of claim 1, wherein the dry basis content is 65-75wt%, and/or, the sodium oxide content is not greater than 0.03wt%, and/or, the phosphorus content in terms of phosphorus pentoxide is 1.4-4.2wt%, relative to 100wt% of the total weight of the pseudo-boehmite.

3. The pseudo-boehmite of claim 1, wherein the phosphoric acid ester group is derived from a compound represented by the following structural formula (I),



(I)

in the structural formula (I), each A is, identical to or different from each other, each independently selected from hydrogen ion, ammonium ion (NH_4^+), a metal ion and a group represented by the structural formula  , R_0 is selected from hydrogen atom, substituted or unsubstituted C_{1-30} linear or branched alkyl and substituted or unsubstituted C_{6-20} aryl, n groups R_1 are, identical to or different from each other, each independently selected from C_{1-6} linear or branched alkylene, n is a number in the range of 0 to 200.

4. The pseudo-boehmite of claim 3, wherein the metal ion is an alkali metal ion or an alkaline earth metal ion.

5. The pseudo-boehmite of claim 3, wherein

at least one A is hydrogen ion, and/or,

R_0 is selected from C_{5-20} linear or branched alkyl and phenyl, and/or,

n groups R_1 are, identical to or different from each other, each independently selected from C_{2-4} linear or branched alkylene, and/or,

n is a number in the range of 0 to 100.

6. The pseudo-boehmite of claim 3, wherein

both of two As are hydrogen ion, and/or,

R_0 is C_9 linear or branched alkyl, and/or,

n groups R_1 are, identical to or different from each other, each independently is ethylene, and/or,

n is a number in the range of 5 to 20.

7. The pseudo-boehmite of claim 1, wherein the gibbsite content is <3.0wt%, relative to 100wt% of the total weight of the pseudo-boehmite.

8. The pseudo-boehmite of claim 1, which further contains at least one auxiliary selected from Si, B and Ti, the content of said at least one auxiliary in term of oxide is 1-8wt%, relative to 100wt% of the total weight of the pseudo-boehmite.

9. The pseudo-boehmite of claim 8, wherein the content of said at least one auxiliary in term of oxide is 2-6wt%, relative to 100wt% of the total weight of the pseudo-boehmite.

10. A manufacturing process of pseudo-boehmite, comprising:

contacting an alkaline aluminum source, a cation-exchange resin and an organic acid source in the presence of water to obtain a mixed liquid, and separating the mixed liquid to obtain the pseudo-boehmite, wherein the alkaline aluminum source is an aluminate, the cation-exchange resin is selected from at least one of macropore strong-acidic styrene-based cation-exchange resin and sulfonated styrene-based gel-type strong-acidic cation-exchange resin, and the organic acid source is selected from at least one of mono-C_9-C_{15}-alkylether phosphoric acid ester, mono-C_9-C_{15}-alkylphosphoric acid ester, di-C_9-C_{15}-alkylphosphoric acid ester and di-C_9-C_{15}-alkylether phosphoric acid ester.

11. The manufacturing process of claim 10, wherein

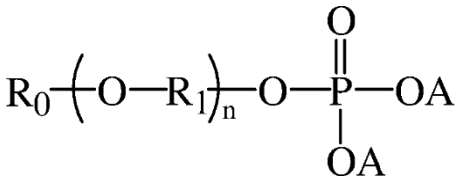
the alkaline aluminum source is sodium meta-aluminate, and/or,

the cation-exchange resin is selected from at least one of D001 macropore strong-acidic styrene-based cation-exchange resin and D61 macropore strong-acidic styrene-based cation-exchange resin, and/or,

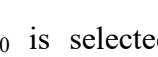
the organic acid source has an acidity coefficient pKa of 3-6.

12. The manufacturing process of claim 10, wherein

the organic acid source is a compound represented by the following structural formula (I),



(I)

in the structural formula (I), each A is, identical to or different from each other, each independently selected from hydrogen ion, ammonium ion (NH_4^+), metal ion, and a group represented by the structural formula , R_0 is selected from hydrogen atom, substituted or unsubstituted C_{1-30} linear or branched alkyl and substituted or unsubstituted C_{6-20} aryl, n groups R_1 are, identical to or different from each other, each independently selected from C_{1-6} linear or branched alkylene, n is a number in the range of 0 to 200.

13. The manufacturing process of claim 12, wherein

at least one A is hydrogen ion, and/or,

R_0 is selected from C_{5-20} linear or branched alkyl and phenyl, and/or,

n groups R_1 are, identical to or different from each other, each independently selected from C_{2-4} linear or branched alkylene, and/or,

n is a number in the range of 0 to 100.

14. The manufacturing process of claim 12, wherein

both of two As are hydrogen ion, and/or,

R_0 is C_9 linear or branched alkyl, and/or,

n groups R_1 are each ethylene, and/or,

n is a number in the range of 5 to 20.

15. The manufacturing process of claim 12, wherein the metal ion is an alkali metal ion or an alkaline earth metal ion.

16. The manufacturing process of claim 10, wherein the weight ratio of the alkaline aluminum source in term of alumina to the organic acid source is 1.2:1 to 24:1, and/or, the

carbon atom number of the organic acid source is up to 30, and/or, the HLB value of the organic acid source is 3-8, and/or, the particle size of the cation-exchange resin is 20-150 mesh.

17. The manufacturing process of claim 16, wherein

the weight ratio of the alkaline aluminum source in term of alumina to the organic acid source is 5:1 to 20:1, and/or,

the carbon atom number of the organic acid source is up to 15, and/or,

the HLB value of the organic acid source is 3-6, and/or,

the particle size of the cation-exchange resin is 40-80 mesh.

18. The manufacturing process of claim 10, comprising the following steps:

(1) reacting the alkaline aluminum source, the organic acid source and one part of the total amount of the cation-exchange resin in the presence of water to obtain a first mixed liquid,

(2) aging the first mixed liquid, and then adding thereto another part of the total amount of the cation-exchange resin to obtain a second mixed liquid,

(3) separating the cation-exchange resin from the second mixed liquid to obtain a slurry, and

(4) after filtering the slurry or without filtering slurry, drying the slurry to obtain the pseudo-boehmite.

19. The manufacturing process of claim 18, wherein the alkaline aluminum source is sodium metalluminate with a caustic ratio of 1.15-1.35, and/or, in the step (1), the reaction temperature is 45°C-80°C, the pH value of the reaction system is 7.5-10, and/or, in the step (2), the aging temperature is 50-100°C, the ageing time is 0.5-3 hours, and/or, in the step (4), the drying temperature is 100-150°C, the drying time is 6-10 hours.

20. The manufacturing process of claim 19, wherein the alkaline aluminum source is sodium metalluminate with a caustic ratio of 1.20-1.30, and/or, in the step (1), the reaction temperature is 50°C-75°C, and/or, the pH value of the reaction system is 8.0-9.5, and/or, in the step (2), the aging temperature is 60-90°C, and/or, the ageing time is 1-2 hours.

21. The manufacturing process of claim 19, comprising the following steps:

(1) reacting an aqueous solution of the alkaline aluminum source, an aqueous solution of the organic acid source and a suspension of said one part of the cation-exchange resin to

obtain the first mixed liquid,

(2) aging the first mixed liquid, and then adding thereto a suspension of said another part of the cation-exchange resin to obtain the second mixed liquid,

(3) separating the cation-exchange resin from the second mixed liquid to obtain a slurry, and

(4) after filtering the slurry or without filtering the slurry, drying the slurry to obtain the pseudo-boehmite, and/or, the aqueous solution of alkaline aluminum source is an aqueous solution of sodium metalluminate with a caustic ratio of 1.15-1.35.

22. The manufacturing process of claim 21, wherein the step (1) is conducted in the presence of water, and/or, in the step (1), the aqueous solution of the alkaline aluminum source, the aqueous solution of the organic acid source and the suspension of the cation-exchange resin are added to water, to obtain the first mixed liquid.

23. The manufacturing process of claim 21, wherein in the step (1), the amount of water is 5-20vol% of the total volume of the reaction system, and/or, in the step (1), in terms of oxide, the concentration of the sodium metalluminate solution is 20-100g Al_2O_3/L, and/or, in the step (1), the flow rate at which the sodium metalluminate solution is added to the reaction system is 20mL/min-60mL/min, and/or, in the step (1), the concentration of the aqueous solution of the organic acid source is 0.05-0.5g/mL, and/or, in the step (1), the flow rate at which the aqueous solution of the organic acid source is added to the reaction system is 5mL/min-10mL/min, and/or, in the step (1), the solid content of the suspension of the cation-exchange resin is 30-80wt%, and/or, in the step (1), the flow rate at which the suspension of the cation-exchange resin is added to the reaction system or the used amount of the suspension of the cation-exchange resin added to the reaction system is such one that the pH value of the reaction system is maintained at 7.5-10, and/or, in the step (2), the used amount of the suspension of the cation-exchange resin added to the reaction system is such one that the pH value of the first mixed liquid reaches 6.0-7.5, the reaction system is the reactor.

24. The manufacturing process of claim 23, wherein in the step (1), the amount of water is 5-15vol% of the total volume of the reaction system, and/or, in the step (1), in terms of oxide, the concentration of the sodium metalluminate solution is 30-70g Al_2O_3/L, and/or, in the step (1), the flow rate at which the sodium metalluminate solution is added to the reaction system is 30mL/min-50mL/min, and/or, in the step (1), the solid content of the suspension of the

cation-exchange resin is 50-80wt%, and/or, in the step (1), the flow rate at which the suspension of the cation-exchange resin is added to the reaction system or the used amount of the suspension of the cation-exchange resin added to the reaction system is such one that the pH value of the reaction system is maintained at 8.0-9.5, and/or, in the step (2), the used amount of the suspension of the cation-exchange resin added to the reaction system is such one that the pH value of the first mixed liquid reaches 6.5-7.0.

25. An alumina having a phosphorus content in terms of the phosphorus element of 0.3-5.0wt%, a pore volume of 0.7-1.2mL/g, a unit surface acid amount of 0.001-0.002mmol/m^2, and a hydraulicity of 3-10N/particle.

26. The alumina of claim 25, wherein
the phosphorus content in terms of the phosphorus element is 0.5-4.5wt%, and/or,
the pore volume is 0.9-1.1mL/g, and/or,
the unit surface acid amount is 0.0015-0.002mmol/m^2, and/or,
the hydraulicity is 5-10N/particle.

27. A manufacturing process of alumina, comprising the following steps:
manufacturing a pseudo-boehmite according to the manufacturing process of claim 10, and
calcining the pseudo-boehmite to obtain the alumina.

28. A catalyst, containing a catalytic active component and a support, wherein said support contains the alumina of claim 25.

29. The catalyst of claim 28, wherein
the catalyst is a hydrogenation catalyst, and/or,
the catalytic active component is selected from at least one of Mo, W, Ni and Co.

30. A manufacturing process of a catalyst, comprising the following steps:
manufacturing a pseudo-boehmite according to the manufacturing process of claim 10,
shaping, after drying or without drying, calcining the pseudo-boehmite to obtain a support, and
loading a catalytic active component to said support to obtain the catalyst.

31. The manufacturing process of claim 30, wherein
the catalyst is a hydrogenation catalyst, and/or,
the catalytic active component is selected from at least one of Mo, W, Ni and Co.

32. A hydrogenation process, comprising a step of hydrogenating an oil product in the presence of the hydrogenation catalyst of claim 28 or a hydrogenation catalyst manufactured by the manufacturing process according to claim 30, under hydrogenation reaction conditions.

33. The hydrogenation process of claim 32, wherein the oil product is selected from at least one of diesel oil, vacuum gas oil, heavy oil and residual oil.

34. The hydrogenation process of claim 32 or 33, wherein the hydrogenation reaction conditions comprise: the reaction pressure is 5-20MPaG, the reaction temperature is 350-500°C, the liquid hourly space velocity is 0.1-2.0 h^{-1}, and the hydrogen/oil volume ratio is 100-1000.