Claims

1. A SAPO-34 molecular sieve whose chemical composition in the anhydrous state is expressed as: $mSDA\cdot(Si_xAl_yP_z)O_2$;

wherein,

SDA represents the template agent existing in micropores of said molecular sieve;

SDA is organic amine with the structural formula as $(CH_3)_2NRN(CH_3)_2$, wherein R is saturated straight-chain or branch-chain alkylene group with the number of carbon atoms at a range from 2 to 5;

m is the molar number of said template agent per one mole of $(SixAlyPz)O_2$, and m is from 0.08 to 0.3;

x, y, z respectively represents the molar number of Si, Al, P, and x is from 0.01 to 0.60, and y is from 0.2 to 0.60, and z is from 0.2 to 0.60, and $x + y + z = 1$;

wherein there is a slight Si enrichment phenomenon on the crystal surface of said molecular sieve crystal, and the ratio of the surface Si content to the bulk Si content of the crystal ranges from 1.50 to 1.01; wherein the Si content is calculated by the molar ratio of Si/(Si+Al+P).

2. A SAPO-34 molecular sieve according to claim 1, wherein ~~there is a slight Si enrichment phenomenon on the crystal surface of said molecular sieve crystal, and~~ the ratio of the surface Si content to the bulk Si content of the crystal ranges from ~~1.50 to 1.01, preferably ranges from~~ 1.42 to 1.02~~, further preferably ranges from 1.35 to 1.03, and more further preferably ranges from 1.30 to 1.03; wherein the Si content is calculated by the molar ratio of Si/(Si+Al+P)~~.

3. A SAPO-34 molecular sieve according to claim 1, wherein the ratio of the surface Si content to the bulk Si content of the crystal ranges from 1.35 to 1.03.

4. A SAPO-34 molecular sieve according to claim 1, wherein the ratio of the surface Si content to the bulk Si content of the crystal ranges from 1.30 to 1.03.

~~3~~5. A SAPO-34 molecular sieve according to claim 1, wherein said template agent SDA is one or more selected from N,N,N',N'-tetramethyl ethylenediamine, N,N,N',N'-tetramethyl-1,3-diaminopropane, N,N,N',N'-tetramethyl-1,4-butanediamine, N,N,N',N'-tetramethyl-1,5-pentane diamine, N,N,N',N'-tetramethyl-1,2-diaminopropane , N,N,N',N'-tetramethyl-1,3-butanediamine, N,N,N',N'-tetramethyl-1,4-pentane diamine.

~~4. A SAPO-34 molecular sieve according to claim 1, wherein the Si contents from core to shell of said molecular sieve crystals increase uniformly.~~

~~5. A SAPO-34 molecular sieve according to claim 1, wherein the Si contents from core to shell of said molecular sieve crystals increase non-uniformly.~~

6. A method for preparing said SAPO-34 molecular sieve according to claim 1, including the steps as follows:

(a) a silicon source, an aluminum source, a phosphorus source, deionized water and SDA are mixed, and an initial gel mixture with following molar ratio is obtained:

SiO_2/Al_2O_3 is from 0.01 to 1;

P_2O_5/Al_2O_3 is from 0.5 to 1.5;

H_2O/Al_2O_3 is from 1 to 19;

SDA/Al_2O_3 is from 5 to 30;

SDA/H_2O is from 0.27 to 30;

wherein, SDA is organic amine with the structural formula as $(CH_3)_2NRN(CH_3)_2$, wherein R is saturated straight-chain or branch-chain alkylene group with the number of carbon atoms at a range from 2 to 5;

(b) the initial gel mixture obtained in said step (a) is transferred into a synthetic kettle, then sealed and heated to crystallization temperature range from 170°C to 220°C, crystallized for crystallization time range from 0.5h to 48h under the autogenous pressure;

(c) after finishing the crystallization, the solid product is centrifugal separated, washed to neutral using deionized water and dried to obtain said SAPO-34 molecular sieve.;

wherein in said step (a), the order of ingredients addation is as follows: firstly, mixing homogeneously the aluminum source and the organic amine SDA by stirring to obtain the mixture A; after continuously stirring the mixture of the silicon source, the phosphorus source and deionized water, mixing homogeneously the mixture A and the mixture by stirring to obtain the initial gel mixture.

7. A method according to claim 6, wherein in the initial gel mixture obtained in said step (a), the silicon source is one or more selected from silica sol, active silica, orthosilicate esters and metakaolin; the aluminum source is one or more selected from aluminum salts, activated alumina, aluminum alkoxide and metakaolin; the phosphorus source is one or more selected from phosphoric acid, diammonium hydrogen phosphate, ammonium dihydrogen phosphate, organophosphorous compounds and phosphorus oxides.

8. A method according to claim 6, wherein in the initial gel mixture obtained in said step (a), the molar ratio of organic amine SDA to water SDA/H_2O is from 0.5 to 30~~, and preferably the molar ratio of SDA to water SDA/H_2O is from 1.0 to 30~~.

9. A method according to claim 6, wherein in the initial gel mixture obtained in said step (a), the molar ratio of organic amine SDA to water SDA/H_2O is from 1.0 to 30.

~~9~~10. A method according to claim 6, wherein in the initial gel mixture obtained in said step (a), the molar ratio of organic amine SDA to Al_2O_3 SDA/Al_2O_3 is from 7.0 to 30.

~~10~~11. A method according to claim 6, wherein the organic amine SDA in said step (a) is selected from N,N,N',N'-tetramethyl ethylenediamine, N,N,N',N'-tetramethyl-1,3-diaminopropane, N,N,N',N'-tetramethyl-1,4-butanediamine, N,N,N',N'-tetramethyl-1,5-pentane diamine, N,N,N',N'-tetramethyl-1,2-diaminopropane, N,N,N',N'-tetramethyl-1,3-butanediamine, N,N,N',N'-tetramethyl-1,4-pentane diamine.

~~11. A method according to claim 6, wherein in said step (a), the order of ingredients addation is as follows: firstly, mixing homogeneously the aluminum source and the organic amine SDA by stirring to obtain the mixture A; after continuously stirring the mixture of the silicon source, the phosphorus source and deionized water, mixing homogeneously the mixture A and the mixture by stirring to obtain the initial gel mixture.~~

12. A method according to claim 6, wherein in said step (b), the crystallization temperature ranges from 180°C to 210°C~~, and preferably the crystallization temperature ranges from 190°C to 210°C~~; the crystallization time ranges from 1h to 24h~~, and preferably the crystallization time ranges from 1h to 12h~~.

13. A method according to claim 6, wherein in said step (b), the crystallization temperature ranges from 190°C to 210°C.

14. A method according to claim 6, wherein in said step (b), the crystallization time ranges from 1h to 12h.

~~13~~15. A method according to claim 6, wherein in said step (b), the crystallization is carried out dynamically.

~~14~~16. A catalyst for acid-catalyzed reaction, which is obtained by calcining at least one of said SAPO-34 molecular sieves according to claims from 1 to 5 or at least one of the SAPO-34 molecular

sieve prepared by said methods according to claims from 6 to ~~13~~15, at a temperature from 400 to 700 °C in air.

~~15~~17. A catalyst for an ~~an~~ oxygenate to olefins reaction, which is obtained by calcining at least one of said SAPO-34 molecular sieves according to claims from 1 to 5 or at least one of the SAPO-34 molecular sieves prepared by said methods according to claims from 6 to ~~13~~15, at a temperature from 400 to 700 °C in air.