Claims

1. A SAPO-34 molecular sieve whose chemical composition in the anhydrous state is expressed as:

$$mDIPA\cdot(Si_xAl_yP_z)O_2;$$

wherein, DIPA is diisopropylamine existing in cages and pore channels of said molecular sieve; m is the molar number of diisopropylamine per one mole of $(SixAlyPz)O_2$, and m is from 0.03 to 0.25;

x, y, z respectively represents the molar number of Si, Al, P, and x is from 0.01 to 0.30, and y is from 0.40 to 0.60, and z is from 0.25 to 0.49, 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 1.48 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 in X-ray diffraction spectrogram of said SAPO-34 molecular sieve, the diffraction peaks are included as follows:

No.	2θ
1	9.5177
2	12.7987
3	14.1388
4	15.9829
5	18.1242
6	20.5413
7	22.278
8	23.0981
9	25.3853
10	25.7835
11	27.5448
12	28.5382
13	29.5454
14	30.4947
15	31.3812
16	34.3501
17	36.4789
18	39.6546
19	43.4168
20	47.4822
21	49.1405
22	50.4542
23	51.1735
24	53.0514
25	53.9912
26	54.7895
27	55.7846
28	56.4017
29	59.6235
30	60.8263

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 1.42 to 1.02.

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 1.36 to 1.03.

5. 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 1.33 to 1.03.

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, a surfactant BM, deionized water and structural-directing agent DIPA are mixed, and an initial gel mixture with following molar ratio is obtained:

SiO_2/Al_2O_3 is from 0.05 to 1.5;

P_2O_5/Al_2O_3 is from 0.5 to 1.5;

H_2O/Al_2O_3 is from 16 to 150;

$DIPA/Al_2O_3$ is from 2.0 to 5.9;

BM/Al_2O_3 is from 0.001 to 0.05;

(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 150°C to 220°C, crystallized for crystallization time range from 0.5h to 72h under an autogenous pressure;

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

wherein, said structural-directing agent DIPA is diisopropylamine; said surfactant BM is alkyl ammonium halide.

7. A method according to claim 6, wherein 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 surfactant BM is one or more selected from dodecyl trimethylammonium chloride, tetradecyl trimethylammonium chloride, cetyl trimethylammonium chloride, octadecyl trimethylammonium chloride, dodecyl trimethylammonium bromide, tetradecyl trimethylammonium bromide, cetyl trimethylammonium bromide, octadecyl trimethylammonium bromide.

9. A method according to claim 6, wherein in the initial gel mixture obtained in said step (a), the molar ratio of H_2O/Al_2O_3 is from 26 to 120.

10. A method according to claim 6, wherein in the initial gel mixture obtained in said step (a), the molar ratio of H_2O/Al_2O_3 is from 31 to 100.

11. A method according to claim 6, wherein in the initial gel mixture obtained in said step (a), the molar ratio of $DIPA/Al_2O_3$ is from 3.0 to 5.0.

12. A method according to claim 6, wherein in the initial gel mixture obtained in said step (a), the molar ratio of BM/Al_2O_3 is from 0.001 to 0.03.

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

14. A method according to claim6, wherein in said step (b), the crystallization temperature ranges from 190°C to 210°C; the crystallization time ranges from 1h to 12h.

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

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

17. ~~A catalyst for~~ An acid-catalyzed reaction~~,~~ process using a catalyst 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 16~~, at a temperature from 400 to 700 °C in air~~.~~;

wherein there is a slight Si enrichment phenomenon on the crystal surface of at least one of said molecular sieves, and the ratio of the surface Si content to the bulk Si content of the crystal ranges from 1.48 to 1.01; wherein the Si content is calculated by the molar ratio of Si/(Si+Al+P).

18. ~~A catalyst for an~~ An oxygenate to olefins reaction~~,~~ process using a catalyst 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 16~~, at a temperature from 400 to 700 °C in air~~.~~;

wherein there is a slight Si enrichment phenomenon on the crystal surface of at least one of said molecular sieves, and the ratio of the surface Si content to the bulk Si content of the crystal ranges from 1.48 to 1.01; wherein the Si content is calculated by the molar ratio of Si/(Si+Al+P).