

Claims

1. A catalytic cracking catalyst, wherein said catalytic cracking catalyst has a cracking active component, an optional mesoporous aluminosilicate material, a clay and a binder, wherein said cracking active component comprises, substantially consists of or consists of: a rare earth-containing Y zeolite, an optional other Y zeolite, and an optional MFI-structured zeolite,

said rare earth-containing Y zeolite has a rare earth content as rare earth oxide of 10-25wt%, e.g. 11-23wt%; a unit cell size of 2.440-2.472nm, e.g. 2.450-2.470nm; a crystallinity of 35-65%, e.g. 40-60%; a Si/Al atom ratio in the skeleton of 2.5-5.0; and a product of the ratio of the strength I_1 of the peak at $2\theta=11.8\pm0.1^\circ$ to the strength I_2 of the peak at $2\theta=12.3\pm0.1^\circ$ in the X-ray diffraction spectrogram of the zeolite and the weight percent of rare earth as rare earth oxide in the zeolite of higher than 48, e.g. higher than 55.

2. The catalytic cracking catalyst according to claim 1, wherein said rare earth-containing Y zeolite has a crystallinity retention after 17 hours of aging treatment at 800°C in a condition of 100% steam of greater than 40%, e.g. greater than 45%.

3. The catalytic cracking catalyst according to claim 1, wherein said mesoporous aluminosilicate material has a pseudoboehmite phase structure, an anhydrous chemical expression formula based on the oxide weight ratio of $(0-0.3)\text{Na}_2\text{O}\cdot(40-90)\text{Al}_2\text{O}_3\cdot(10-60)\text{SiO}_2$, an average pore diameter of 5-25nm, a most probable pore diameter of 5-15nm, a specific surface area of 200-400m²/g, and a pore volume of 0.5-2.0ml/g;

said clay is selected from the group consisting of kaolin, metahalloysite, montmorillonite, diatomite, halloysite, saponite, rectorite, sepiolite, attapulgite, hydrotalcite, bentonite and any mixture thereof; and

said binder is selected from the group consisting of silica sol, alumina sol, pseudoboehmite and any mixture thereof.

4. The catalytic cracking catalyst according to claim 1, wherein per 100 weight parts of the catalytic cracking catalyst, said catalytic cracking catalyst contains 10-60 weight parts of the cracking active component, 10-70 weight parts of the clay, 10-60 weight parts of the binder, and 0-20 weight parts of the mesoporous aluminosilicate material.

5. The catalytic cracking catalyst according to claim 1, wherein said other Y zeolite is selected from the group consisting of rare earth-containing DASY zeolite, rare earth-containing gas-phase ultra stable Y zeolite and Mg-containing ultra stable Y zeolite.

6. The catalytic cracking catalyst according to claim 1, wherein said cracking active component comprises, substantially consists of or consists of:

the rare earth-containing Y zeolite,

optionally,

the rare earth-containing DASY zeolite, and

optionally, only one of the rare earth-containing gas-phase ultra stable Y zeolite, the Mg-containing ultra stable Y zeolite and the MFI-structured zeolite.

7. The catalytic cracking catalyst according to claim 1, wherein per 100 weight parts of the catalytic cracking catalyst, said catalytic cracking catalyst contains 10-40 weight parts of the rare earth-containing Y zeolite, 0-15 weight parts of the rare earth-containing DASY zeolite, and 0-25 weight parts of only one of the rare earth-containing gas-phase ultra stable Y zeolite, the Mg-containing ultra stable Y zeolite and the MFI-structured zeolite.

8. The catalytic cracking catalyst according to claim 1, wherein said rare earth-containing Y zeolite is prepared by a process comprising the following steps:

(1) a NaY zeolite and a rare earth solution or a mixed solution of ammonium salt and rare earth solution are contacted to obtain a rare earth- and sodium-containing Y zeolite;

(2) the rare earth- and sodium-containing Y zeolite obtained in step (1) is subjected to

a first calcination to obtain a rare earth- and sodium-containing Y zeolite;

(3) then either the rare earth- and sodium-containing Y zeolite obtained in step (2) is contacted with an ammonium salt solution or an acid solution, and then mixed with a rare earth solution, and the mixture is adjusted to a pH of 6-10, or the rare earth- and sodium-containing Y zeolite obtained in step (2) is contacted with a mixed solution of ammonium salt and rare earth solution, and then the mixture is adjusted to a pH of 6-10, to obtain a rare earth- and sodium-containing Y zeolite;

(4) the rare earth- and sodium-containing Y zeolite obtained in step (3) is subjected to a second calcination to obtain the target rare earth-containing Y zeolite.

9. The catalytic cracking catalyst according to claim 1, wherein said rare earth-containing Y zeolite is prepared by a process comprising the following steps:

(1) a NaY zeolite and a rare earth solution or a mixed solution of ammonium salt and rare earth solution are contacted to obtain a rare earth- and sodium-containing Y zeolite;

(2) the rare earth- and sodium-containing Y zeolite obtained in step (1), after being filtered and washed with water, and dried, is subjected to a first calcination to obtain a rare earth- and sodium-containing Y zeolite;

(3) then either the rare earth- and sodium-containing Y zeolite obtained in step (2) is contacted with an ammonium salt solution, and then mixed with a rare earth solution without filtration, and the mixture is adjusted to a pH of 6-10, or the rare earth- and sodium-containing Y zeolite obtained in step (2) is contacted with a mixed solution of ammonium salt and rare earth solution, and then the mixture is adjusted to a pH of 6-10, to obtain a rare earth- and sodium-containing Y zeolite;

(4) the rare earth- and sodium-containing Y zeolite obtained in step (3), after being filtered and washed with water, and dried, is subjected to a second calcination to obtain the target rare earth-containing Y zeolite.

10. The catalytic cracking catalyst according to claim 1, wherein said rare earth-containing Y zeolite is prepared by a process comprising the following steps:

(1) a NaY zeolite and a rare earth solution or a mixed solution of ammonium salt and rare earth solution are contacted to obtain a rare earth- and sodium-containing Y

zeolite;

(2) the rare earth- and sodium-containing Y zeolite obtained in step (1), after being filtered and washed with water, and dried, is subjected to a first calcination to obtain a rare earth- and sodium-containing Y zeolite;

(3) the rare earth- and sodium-containing Y zeolite obtained in step (2) is contacted with an ammonium salt solution or an acid solution, filtered, and then mixed with a rare earth solution, and the mixture is adjusted to a pH of 6-10, to obtain a rare earth- and sodium-containing Y zeolite;

(4) the rare earth- and sodium-containing Y zeolite obtained in step (3), after being optionally filtered and washed with water, and dried, is subjected to a second calcination to obtain the target rare earth-containing Y zeolite.

11. The catalytic cracking catalyst according to any one of claims 8-10, wherein the ammonium salt is selected from the group consisting of ammonium chloride, ammonium nitrate, ammonium carbonate, ammonium hydrogen carbonate and any mixture thereof.

12. The catalytic cracking catalyst according to any one of claims 8-10, wherein in step (1),

the weight ratio of the rare earth solution (as rare earth oxide) to the NaY zeolite (on the dry basis) is 0.06-0.14, e.g. 0.07-0.12, the weight ratio of the ammonium salt (as ammonium chloride) to the rare earth solution (as rare earth oxide) is 0-10, e.g. 0-5, such as 0.2-3, said ammonium salt is selected from the group consisting of ammonium chloride, ammonium nitrate, ammonium carbonate, ammonium hydrogen carbonate and any mixture thereof, the pH is adjusted to 3.0-5.0, the weight ratio of water:zeolite is controlled to 5-30, e.g. 7-15, said contact is conducted at room temperature (such as 18-26°C) to 100°C, e.g. 70-95°C for at least 0.3 hour, e.g. 0.5-3 hours, such as 0.5-1.5 hours.

13. The catalytic cracking catalyst according to any one of claims 8-10, wherein in step (2),

said first calcination is conducted at 500-650°C, e.g. 530-630°C, such as 550-620°C,

in a condition of 0-100% steam for at least 0.5 hour, e.g. 0.5-4.0 hours, 1.0-4.0 hours or 1.5-3.0 hours.

14. The catalytic cracking catalyst according to any one of claims 8-10, wherein in step (3),

for the case of contacting the rare earth- and sodium-containing Y zeolite with the ammonium salt solution, the contact is conducted at room temperature to 100°C, e.g. 60-80°C for at least 0.3 hour, e.g. 0.3-3.0 hours, 0.5-3 hours or 0.5-1.5 hours, wherein for the proportions of the rare earth- and sodium-containing Y zeolite and the ammonium salt solution, the weight ratio of the zeolite (dry basis):ammonium salt:water is 1:(0.05-0.5):(5-30), e.g. 1:(0.1-0.4):(8-15); the rare earth solution is subsequently added in such an amount that the weight ratio of the rare earth element (as rare earth oxide (RE_2O_3)) in the rare earth solution to the rare earth- and sodium-containing Y zeolite (on a dry basis of the zeolite) is 0.01-0.2, e.g., 0.02-0.12; said ammonium salt is selected from the group consisting of ammonium chloride, ammonium nitrate, ammonium carbonate, ammonium hydrogen carbonate and any mixture thereof;

for the case of contacting the rare earth- and sodium-containing Y zeolite with the acid solution, the contact is conducted at room temperature to 100°C, e.g. 60-80°C for at least 0.3 hour, e.g. 0.3-3.0 hours, 0.5-3 hours or 0.5-1.5 hours, wherein for the proportions of the rare earth- and sodium-containing Y zeolite and the acid solution, the weight ratio of zeolite (dry basis):acid:water is 1:(0.03-0.2):(5-30), e.g. 1:(0.05-0.1):(8-15); the rare earth solution is subsequently added in such an amount that the weight ratio of the rare earth element (as rare earth oxide (RE_2O_3)) in the rare earth solution to the rare earth- and sodium-containing Y zeolite (on a dry basis of the zeolite) is 0.01-0.2, e.g., 0.02-0.12; said acid can be an inorganic acid or an organic acid, the inorganic acid can be selected from the group consisting of sulphuric acid, hydrochloric acid, nitric acid and any mixture thereof, the organic acid can be selected from the group consisting of oxalic acid, acetic acid, citric acid, tartaric acid, and any mixture thereof;

for the case of contacting the rare earth- and sodium-containing Y zeolite with the mixed solution of ammonium salt and rare earth solution, the contact is conducted at

room temperature to 100°C, e.g. 60-80°C for at least 0.3 hour, e.g. 0.3-3.0 hours, 0.5-3 hours or 0.5-1.5 hours, wherein for the proportions of the rare earth- and sodium-containing Y zeolite, the ammonium salt, and the rare earth solution, the weight ratio of zeolite (dry basis):ammonium salt:rare earth oxide (RE_2O_3):water is 1:(0.05-0.5):(0.01-0.2):(5-30), e.g. 1:(0.1-0.4):(0.02-0.12):(8-15); said ammonium salt is selected from the group consisting of ammonium chloride, ammonium nitrate, ammonium carbonate, ammonium hydrogen carbonate and any mixture thereof.

15. The catalytic cracking catalyst according to claim 14, wherein in step (3), after the contact, the mixture is adjusted with an alkaline liquid to a pH of 6-10, e.g. 7-9, such as 7.5-8.2.

16. The catalytic cracking catalyst according to claim 15, wherein said alkaline liquid can be selected from the group consisting of aqueous ammonia, sodium silicate, sodium metaaluminate, sodium hydroxide and any mixture thereof.

17. The catalytic cracking catalyst according to any one of claims 8-10, wherein in step (4), said second calcination is conducted at 500-650°C, in a condition of 0-100% steam for 0.5-4 hours, e.g. 1-3 hours.

18. A process for preparing a catalytic cracking catalyst, which process comprises: preparing a slurry containing an cracking active component, an optional mesoporous aluminosilicate material, a clay and a binder; and spray-drying the prepared slurry, wherein said cracking active component comprises, substantially consists of or consists of: a rare earth-containing Y zeolite, an optional other Y zeolite, and an optional MFI-structured zeolite, wherein said rare earth-containing Y zeolite has a rare earth content as rare earth oxide of 10-25wt%, e.g. 11-23wt%; a unit cell size of 2.440-2.472nm, e.g. 2.450-2.470nm; a crystallinity of 35-65%, e.g. 40-60%; a Si/Al atom ratio in the skeleton of 2.5-5.0; and a product of the ratio of the strength I_1 of the peak at $2\theta=11.8\pm0.1^\circ$ to the strength I_2 of the peak at $2\theta=12.3\pm0.1^\circ$ in the X-ray diffraction spectrogram of the zeolite and the weight percent of rare earth as rare earth oxide in

the zeolite of higher than 48, e.g. higher than 55.

19. The process for preparing the catalytic cracking catalyst according to claim 18, wherein

said mesoporous aluminosilicate material has a pseudoboehmite phase structure, an anhydrous chemical expression formula based on the oxide weight ratio of $(0-0.3)\text{Na}_2\text{O} \cdot (40-90)\text{Al}_2\text{O}_3 \cdot (10-60)\text{SiO}_2$, an average pore diameter of 5-25nm, a most probable pore diameter of 5-15nm, a specific surface area of 200-400m²/g, and a pore volume of 0.5-2.0ml/g;

said clay is selected from the group consisting of kaolin, metahalloysite, montmorillonite, diatomite, halloysite, saponite, rectorite, sepiolite, attapulgite, hydrotalcite, bentonite and any mixture thereof;

said binder is selected from the group consisting of silica sol, alumina sol, pseudoboehmite and any mixture thereof.

20. The process for preparing the catalytic cracking catalyst according to claim 18, wherein per 100 weight parts of the catalytic cracking catalyst, 10-60 weight parts of the cracking active component, 10-70 weight parts of the clay, 10-60 weights parts of the binder, 0-20 weight parts of the mesoporous aluminosilicate material are used on the dry basis to prepare the slurry.

21. The process for preparing the catalytic cracking catalyst according to claim 18, wherein said other Y zeolite is selected from the group consisting of rare earth-containing DASY zeolite, rare earth-containing gas-phase ultra stable Y zeolite and Mg-containing ultra stable Y zeolite.

22. The process for preparing the catalytic cracking catalyst according to claim 18, wherein said cracking active component comprises, substantially consists of or consists of:

the rare earth-containing Y zeolite,

optionally,

the rare earth-containing DASY zeolite, and

optionally, only one of the rare earth-containing gas-phase ultra stable Y zeolite, the Mg-containing ultra stable Y zeolite and the MFI-structured zeolite.

23 The process for preparing the catalytic cracking catalyst according to claim 18, wherein per 100 weight parts of the catalytic cracking catalyst, 10-40 weight parts of the rare earth-containing Y zeolite, 0-15 weight parts of the rare earth-containing DASY zeolite, and 0-25 weight parts of only one of the rare earth-containing gas-phase ultra stable Y zeolite, the Mg-containing ultra stable Y zeolite and the MFI-structured zeolite are used on the dry basis to prepare the slurry.

24. The process for preparing the catalytic cracking catalyst according to claim 18, wherein said rare earth-containing Y zeolite is prepared according to the process as defined in any one of claims 8-17.

Claims

1. A catalytic cracking catalyst, wherein said catalytic cracking catalyst has a cracking
5 active component, an optional mesoporous aluminosilicate material, a clay and a binder,
wherein said cracking active component comprises, substantially consists of or consists
of: a rare earth-containing Y zeolite, an optional other Y zeolite, and an optional MFI-
structured zeolite,
said rare earth-containing Y zeolite has a rare earth content as rare earth oxide of 10-
10 25wt%; a unit cell size of 2.440-2.472nm; a crystallinity of 35-65%; a Si/Al atom ratio
in the skeleton of 2.5-5.0; and a product of the ratio of the strength I_1 of the peak at
 $2\theta=11.8\pm0.1^\circ$ to the strength I_2 of the peak at $2\theta=12.3\pm0.1^\circ$ in the X-ray diffraction
spectrogram of the zeolite and the weight percent of rare earth as rare earth oxide in the
zeolite of higher than 48.
- 15 2. The catalytic cracking catalyst according to claim 1, wherein said rare earth-
containing Y zeolite has a crystallinity retention after 17 hours of aging treatment at
800°C in a condition of 100% steam of greater than 40%.
- 20 3. The catalytic cracking catalyst according to claim 1, wherein said rare earth-
containing Y zeolite has a rare earth content as rare earth oxide of 11-23wt%; a unit
cell size of 2.450-2.470nm; a crystallinity of 40-60%.
4. The catalytic cracking catalyst according to claim 3, wherein said rare earth-
25 containing Y zeolite has a crystallinity retention after 17 hours of aging treatment at
800°C in a condition of 100% steam of greater than 45%.
5. The catalytic cracking catalyst according to any one of claims 1-4, wherein said rare
earth-containing Y zeolite has a product of the ratio of the strength I_1 of the peak at
30 $2\theta=11.8\pm0.1^\circ$ to the strength I_2 of the peak at $2\theta=12.3\pm0.1^\circ$ in the X-ray diffraction
spectrogram of the zeolite and the weight percent of rare earth as rare earth oxide in the
zeolite of higher than 55.

6. The catalytic cracking catalyst according to claim 1, wherein

said mesoporous aluminosilicate material has a pseudoboehmite phase structure, an anhydrous chemical expression formula based on the oxide weight ratio of (0-0.3)Na₂O·(40-90)Al₂O₃·(10-60)SiO₂, an average pore diameter of 5-25nm, a most probable pore diameter of 5-15nm, a specific surface area of 200-400m²/g, and a pore volume of 0.5-2.0ml/g;

said clay is selected from the group consisting of kaolin, metahalloysite, montmorillonite, diatomite, halloysite, saponite, rectorite, sepiolite, attapulgite, hydrotalcite, bentonite and any mixture thereof; and

said binder is selected from the group consisting of silica sol, alumina sol, pseudoboehmite and any mixture thereof.

7. The catalytic cracking catalyst according to claim 1, wherein per 100 weight parts of the catalytic cracking catalyst, said catalytic cracking catalyst contains 10-60 weight parts of the cracking active component, 10-70 weight parts of the clay, 10-60 weight parts of the binder, and 0-20 weight parts of the mesoporous aluminosilicate material.

8. The catalytic cracking catalyst according to claim 1, wherein said other Y zeolite is selected from the group consisting of rare earth-containing DASY zeolite, rare earth-containing gas-phase ultra stable Y zeolite and Mg-containing ultra stable Y zeolite.

9. The catalytic cracking catalyst according to claim 1, wherein said cracking active component comprises, substantially consists of or consists of:

the rare earth-containing Y zeolite,

optionally,

the rare earth-containing DASY zeolite, and

optionally, only one of the rare earth-containing gas-phase ultra stable Y zeolite, the Mg-containing ultra stable Y zeolite and the MFI-structured zeolite.

10. The catalytic cracking catalyst according to claim 1, wherein per 100 weight parts of the catalytic cracking catalyst, said catalytic cracking catalyst contains 10-40 weight

parts of the rare earth-containing Y zeolite, 0-15 weight parts of the rare earth-containing DASY zeolite, and 0-25 weight parts of only one of the rare earth-containing gas-phase ultra stable Y zeolite, the Mg-containing ultra stable Y zeolite and the MFI-structured zeolite.

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11. The catalytic cracking catalyst according to claim 1, wherein said rare earth-containing Y zeolite is prepared by a process comprising the following steps:

(1) a NaY zeolite and a rare earth solution or a mixed solution of ammonium salt and rare earth solution are contacted to obtain a rare earth- and sodium-containing Y zeolite;

10 (2) the rare earth- and sodium-containing Y zeolite obtained in step (1) is subjected to a first calcination to obtain a rare earth- and sodium-containing Y zeolite;

(3) then either the rare earth- and sodium-containing Y zeolite obtained in step (2) is contacted with an ammonium salt solution or an acid solution, and then mixed with a rare earth solution, and the mixture is adjusted to a pH of 6-10, or the rare earth- and

15 sodium-containing Y zeolite obtained in step (2) is contacted with a mixed solution of ammonium salt and rare earth solution, and then the mixture is adjusted to a pH of 6-10, to obtain a rare earth- and sodium-containing Y zeolite;

(4) the rare earth- and sodium-containing Y zeolite obtained in step (3) is subjected to a second calcination to obtain the target rare earth-containing Y zeolite.

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12. The catalytic cracking catalyst according to claim 1, wherein said rare earth-containing Y zeolite is prepared by a process comprising the following steps:

(1) a NaY zeolite and a rare earth solution or a mixed solution of ammonium salt and rare earth solution are contacted to obtain a rare earth- and sodium-containing Y zeolite;

25 (2) the rare earth- and sodium-containing Y zeolite obtained in step (1), after being filtered and washed with water, and dried, is subjected to a first calcination to obtain a rare earth- and sodium-containing Y zeolite;

(3) then either the rare earth- and sodium-containing Y zeolite obtained in step (2) is contacted with an ammonium salt solution, and then mixed with a rare earth solution

30 without filtration, and the mixture is adjusted to a pH of 6-10, or the rare earth- and sodium-containing Y zeolite obtained in step (2) is contacted with a mixed solution of ammonium salt and rare earth solution, and then the mixture is adjusted to a pH of 6-

10, to obtain a rare earth- and sodium-containing Y zeolite;

(4) the rare earth- and sodium-containing Y zeolite obtained in step (3), after being filtered and washed with water, and dried, is subjected to a second calcination to obtain the target rare earth-containing Y zeolite.

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13. The catalytic cracking catalyst according to claim 1, wherein said rare earth-containing Y zeolite is prepared by a process comprising the following steps:

(1) a NaY zeolite and a rare earth solution or a mixed solution of ammonium salt and rare earth solution are contacted to obtain a rare earth- and sodium-containing Y zeolite;

10 (2) the rare earth- and sodium-containing Y zeolite obtained in step (1), after being filtered and washed with water, and dried, is subjected to a first calcination to obtain a rare earth- and sodium-containing Y zeolite;

(3) the rare earth- and sodium-containing Y zeolite obtained in step (2) is contacted with an ammonium salt solution or an acid solution, filtered, and then mixed with a rare
15 earth solution, and the mixture is adjusted to a pH of 6-10, to obtain a rare earth- and sodium-containing Y zeolite;

(4) the rare earth- and sodium-containing Y zeolite obtained in step (3), after being optionally filtered and washed with water, and dried, is subjected to a second calcination to obtain the target rare earth-containing Y zeolite.

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14. The catalytic cracking catalyst according to any one of claims 11-13, wherein the ammonium salt is selected from the group consisting of ammonium chloride, ammonium nitrate, ammonium carbonate, ammonium hydrogen carbonate and any mixture thereof.

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15. The catalytic cracking catalyst according to any one of claims 11-13, wherein in step (1),

the weight ratio of the rare earth solution (as rare earth oxide) to the NaY zeolite (on the dry basis) is 0.06-0.14, the weight ratio of the ammonium salt (as ammonium
30 chloride) to the rare earth solution (as rare earth oxide) is 0-10, said ammonium salt is selected from the group consisting of ammonium chloride, ammonium nitrate, ammonium carbonate, ammonium hydrogen carbonate and any mixture thereof, the pH

is adjusted to 3.0-5.0, the weight ratio of water:zeolite is controlled to 5-30, said contact is conducted at room temperature to 100°C, for at least 0.3 hour.

16. The catalytic cracking catalyst according to claim 15, wherein the room temperature
5 is 18-26 °C.

17. The catalytic cracking catalyst according to any one of claims 11-13, wherein in
step (1),
the weight ratio of the rare earth solution (as rare earth oxide) to the NaY zeolite (on
10 the dry basis) is 0.07-0.12, the weight ratio of the ammonium salt (as ammonium
chloride) to the rare earth solution (as rare earth oxide) is 0.2-3, said ammonium salt is
selected from the group consisting of ammonium chloride, ammonium nitrate,
ammonium carbonate, ammonium hydrogen carbonate and any mixture thereof, the pH
is adjusted to 3.0-5.0, the weight ratio of water:zeolite is controlled to 7-15, said contact
15 is conducted at 70-95°C for 0.5-1.5 hours.

18. The catalytic cracking catalyst according to any one of claims 11-13, wherein in
step (2),
said first calcination is conducted at 500-650°C, in a condition of 0-100% steam for at
20 least 0.5 hour.

19. The catalytic cracking catalyst according to any one of claims 11-13, wherein in
step (2),
said first calcination is conducted at 550-620°C, in a condition of 0-100% steam for
25 1.5-3.0 hours.

20. The catalytic cracking catalyst according to any one of claims 11-13, wherein in
step (3),
for the case of contacting the rare earth- and sodium-containing Y zeolite with the
30 ammonium salt solution, the contact is conducted at room temperature to 100°C for at
least 0.3 hour, wherein for the proportions of the rare earth- and sodium-containing Y
zeolite and the ammonium salt solution, the weight ratio of the zeolite (dry

basis):ammonium salt:water is 1:(0.05-0.5):(5-30); the rare earth solution is subsequently added in such an amount that the weight ratio of the rare earth element (as rare earth oxide (RE_2O_3)) in the rare earth solution to the rare earth- and sodium-containing Y zeolite (on a dry basis of the zeolite) is 0.01-0.2; said ammonium salt is
 5 selected from the group consisting of ammonium chloride, ammonium nitrate, ammonium carbonate, ammonium hydrogen carbonate and any mixture thereof;
 for the case of contacting the rare earth- and sodium-containing Y zeolite with the acid solution, the contact is conducted at room temperature to 100°C for at least 0.3 hour, wherein for the proportions of the rare earth- and sodium-containing Y zeolite and the
 10 acid solution, the weight ratio of zeolite (dry basis):acid:water is 1:(0.03-0.2):(5-30); the rare earth solution is subsequently added in such an amount that the weight ratio of the rare earth element (as rare earth oxide (RE_2O_3)) in the rare earth solution to the rare earth- and sodium-containing Y zeolite (on a dry basis of the zeolite) is 0.01-0.2; said acid can be an inorganic acid or an organic acid, the inorganic acid can be selected from
 15 the group consisting of sulphuric acid, hydrochloric acid, nitric acid and any mixture thereof, the organic acid can be selected from the group consisting of oxalic acid, acetic acid, citric acid, tartaric acid, and any mixture thereof;
 for the case of contacting the rare earth- and sodium-containing Y zeolite with the mixed solution of ammonium salt and rare earth solution, the contact is conducted at
 20 room temperature to 100°C for at least 0.3 hour, wherein for the proportions of the rare earth- and sodium-containing Y zeolite, the ammonium salt, and the rare earth solution, the weight ratio of zeolite (dry basis):ammonium salt:rare earth oxide (RE_2O_3):water is 1:(0.05-0.5):(0.01-0.2):(5-30); said ammonium salt is selected from the group consisting of ammonium chloride, ammonium nitrate, ammonium carbonate,
 25 ammonium hydrogen carbonate and any mixture thereof.

21. The catalytic cracking catalyst according to claim 20, wherein the room temperature is 18-26 °C.

30 22. The catalytic cracking catalyst according to any one of claims 11-13, wherein in step (3),
 for the case of contacting the rare earth- and sodium-containing Y zeolite with the

ammonium salt solution, the contact is conducted at 60-80°C for 0.5-1.5 hours, wherein for the proportions of the rare earth- and sodium-containing Y zeolite and the ammonium salt solution, the weight ratio of the zeolite (dry basis):ammonium salt:water is 1:(0.1-0.4):(8-15); the rare earth solution is subsequently added in such an amount that the weight ratio of the rare earth element (as rare earth oxide (RE_2O_3)) in the rare earth solution to the rare earth- and sodium-containing Y zeolite (on a dry basis of the zeolite) is 0.02-0.12; said ammonium salt is selected from the group consisting of ammonium chloride, ammonium nitrate, ammonium carbonate, ammonium hydrogen carbonate and any mixture thereof;

for the case of contacting the rare earth- and sodium-containing Y zeolite with the acid solution, the contact is conducted at 60-80°C for 0.5-1.5 hours, wherein for the proportions of the rare earth- and sodium-containing Y zeolite and the acid solution, the weight ratio of zeolite (dry basis):acid:water is 1:(0.05-0.1):(8-15); the rare earth solution is subsequently added in such an amount that the weight ratio of the rare earth element (as rare earth oxide (RE_2O_3)) in the rare earth solution to the rare earth- and sodium-containing Y zeolite (on a dry basis of the zeolite) is 0.02-0.12; said acid can be an inorganic acid or an organic acid, the inorganic acid can be selected from the group consisting of sulphuric acid, hydrochloric acid, nitric acid and any mixture thereof, the organic acid can be selected from the group consisting of oxalic acid, acetic acid, citric acid, tartaric acid, and any mixture thereof;

for the case of contacting the rare earth- and sodium-containing Y zeolite with the mixed solution of ammonium salt and rare earth solution, the contact is conducted at 60-80°C for 0.5-1.5 hours, wherein for the proportions of the rare earth- and sodium-containing Y zeolite, the ammonium salt, and the rare earth solution, the weight ratio of zeolite (dry basis):ammonium salt:rare earth oxide (RE_2O_3):water is 1:(0.1-0.4):(0.02-0.12):(8-15); said ammonium salt is selected from the group consisting of ammonium chloride, ammonium nitrate, ammonium carbonate, ammonium hydrogen carbonate and any mixture thereof.

23. The catalytic cracking catalyst according to claim 20, wherein in step (3), after the contact, the mixture is adjusted with an alkaline liquid to a pH of 6-10.

24. The catalytic cracking catalyst according to claim 22, wherein in step (3), after the contact, the mixture is adjusted with an alkaline liquid to a pH of 7.5-8.2.

25. The catalytic cracking catalyst according to claim 23, wherein said alkaline liquid can be selected from the group consisting of aqueous ammonia, sodium silicate, sodium metaaluminate, sodium hydroxide and any mixture thereof.

26. The catalytic cracking catalyst according to claim 24, wherein said alkaline liquid can be selected from the group consisting of aqueous ammonia, sodium silicate, sodium metaaluminate, sodium hydroxide and any mixture thereof.

27. The catalytic cracking catalyst according to any one of claims 11-13, wherein in step (4), said second calcination is conducted at 500-650°C, in a condition of 0-100% steam for 0.5-4 hours.

28. The catalytic cracking catalyst according to any one of claims 11-13, wherein in step (4), said second calcination is conducted at 500-650°C, in a condition of 0-100% steam for 1-3 hours.

29. A process for preparing a catalytic cracking catalyst, which process comprises: preparing a slurry containing an cracking active component, an optional mesoporous aluminosilicate material, a clay and a binder; and spray-drying the prepared slurry, wherein said cracking active component comprises, substantially consists of or consists of: a rare earth-containing Y zeolite, an optional other Y zeolite, and an optional MFI-structured zeolite,

wherein said rare earth-containing Y zeolite has a rare earth content as rare earth oxide of 10-25wt%; a unit cell size of 2.440-2.472nm; a crystallinity of 35-65%; a Si/Al atom ratio in the skeleton of 2.5-5.0; and a product of the ratio of the strength I_1 of the peak at $2\theta=11.8\pm0.1^\circ$ to the strength I_2 of the peak at $2\theta=12.3\pm0.1^\circ$ in the X-ray diffraction spectrogram of the zeolite and the weight percent of rare earth as rare earth oxide in the zeolite of higher than 48.

30. A process for preparing a catalytic cracking catalyst, which process comprises: preparing a slurry containing an cracking active component, an optional mesoporous aluminosilicate material, a clay and a binder; and spray-drying the prepared slurry, wherein said cracking active component comprises, substantially consists of or consists of: a rare earth-containing Y zeolite, an optional other Y zeolite, and an optional MFI-structured zeolite,

wherein said rare earth-containing Y zeolite has a rare earth content as rare earth oxide of 11-23wt%; a unit cell size of 2.450-2.470nm; a crystallinity of 40-60%; a Si/Al atom ratio in the skeleton of 2.5-5.0; and a product of the ratio of the strength I_1 of the peak at $2\theta=11.8\pm0.1^\circ$ to the strength I_2 of the peak at $2\theta=12.3\pm0.1^\circ$ in the X-ray diffraction spectrogram of the zeolite and the weight percent of rare earth as rare earth oxide in the zeolite of higher than 55.

31. The process for preparing the catalytic cracking catalyst according to claim 29 or 30, wherein

said mesoporous aluminosilicate material has a pseudoboehmite phase structure, an anhydrous chemical expression formula based on the oxide weight ratio of $(0-0.3)\text{Na}_2\text{O}\cdot(40-90)\text{Al}_2\text{O}_3\cdot(10-60)\text{SiO}_2$, an average pore diameter of 5-25nm, a most probable pore diameter of 5-15nm, a specific surface area of 200-400m²/g, and a pore volume of 0.5-2.0ml/g;

said clay is selected from the group consisting of kaolin, metahalloysite, montmorillonite, diatomite, halloysite, saponite, rectorite, sepiolite, attapulgite, hydrotalcite, bentonite and any mixture thereof;

said binder is selected from the group consisting of silica sol, alumina sol, pseudoboehmite and any mixture thereof.

32. The process for preparing the catalytic cracking catalyst according to claim 29 or 30, wherein per 100 weight parts of the catalytic cracking catalyst, 10-60 weight parts of the cracking active component, 10-70 weight parts of the clay, 10-60 weights parts of the binder, 0-20 weight parts of the mesoporous aluminosilicate material are used on the dry basis to prepare the slurry.

33. The process for preparing the catalytic cracking catalyst according to claim 29 or 30, wherein said other Y zeolite is selected from the group consisting of rare earth-containing DASY zeolite, rare earth-containing gas-phase ultra stable Y zeolite and Mg-containing ultra stable Y zeolite.

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34. The process for preparing the catalytic cracking catalyst according to claim 29 or 30, wherein said cracking active component comprises, substantially consists of or consists of:

the rare earth-containing Y zeolite,

10 optionally,

the rare earth-containing DASY zeolite, and

optionally, only one of the rare earth-containing gas-phase ultra stable Y zeolite, the Mg-containing ultra stable Y zeolite and the MFI-structured zeolite.

15 35. The process for preparing the catalytic cracking catalyst according to claim 29 or 30, wherein per 100 weight parts of the catalytic cracking catalyst, 10-40 weight parts of the rare earth-containing Y zeolite, 0-15 weight parts of the rare earth-containing DASY zeolite, and 0-25 weight parts of only one of the rare earth-containing gas-phase ultra stable Y zeolite, the Mg-containing ultra stable Y zeolite and the MFI-structured
20 zeolite are used on the dry basis to prepare the slurry.

36. The process for preparing the catalytic cracking catalyst according to claim 29 or 30, wherein said rare earth-containing Y zeolite is prepared according to the process as defined in any one of claims 11-28.