Claims

1. A catalytic cracking catalyst, which is characterized in that the catalyst contains a rare earth-containing molecular sieve, and the rare earth dispersion D value of the catalyst is 0.8-1, preferably 0.85-0.99, more preferably 0.86-0.98; wherein the D value is determined by randomly selecting any section of a catalyst, selecting 20 small squares with a side length of 10nm on said section, and obtaining the rare earth content (number of atoms/number of atoms) within each small square through electron probe microanalysis (EPMA), taking the ratio of the lowest value of the 20 rare earth contents to the average value of the 20 rare earth contents as the d value of the section, and taking the average value of the d values of 5 sections with a spacing greater than 50nm between each other as the D value of the catalyst;

on the 100 wt% dry basis, the catalytic cracking catalyst contains:

15-30 wt% of an inorganic oxide binder,

33-48 wt% of a natural mineral, and

30-50 wt% of a rare earth-containing molecular sieve.

2. The catalytic cracking catalyst according to claim 1, which is characterized in that said rare earth-containing molecular sieve has a FAU structure, preferably said rare earth-containing molecular sieve is a rare earth-containing Y-type molecular sieve.

3. The catalytic cracking catalyst according to any of claims 1-2, which is characterized in that on the dry basis, the alkali metal content of the catalytic cracking catalyst (as oxide) is ≤0.3 wt%, preferably, ≤0.2 wt%.

4. The catalytic cracking catalyst according to any of claims 1-3, which is characterized in that the crystallinity retention of the catalytic cracking catalyst is 42.5%-45.5%,

wherein

crystallinity retention (%) = 100 - (crystallinity of fresh sample - crystallinity

of aged sample)/crystallinity of fresh sample * 100,

the aged sample is obtained by aging a fresh sample at 800°C in a 100% water vapor for 17 hours.

5. A process for preparing the catalytic cracking catalyst according to any of claims 1-4, which is characterized in that the process comprises:

(1) contacting a molecular sieve (e.g. NaY molecular sieve) with a rare-earth salt solution or a mixed solution of rare-earth salt solution and ammonium salt solution, and filtering and water-washing the obtained rare earth-containing molecular sieve;

(2) mixing raw materials including an inorganic oxide binder, a natural mineral, and a rare earth-containing molecular sieve, slurrying, and shaping to obtain shaped bodies;

(3) hydrothermally calcining the shaped bodies in an atmosphere condition where a pressure is externally applied and an aqueous solution containing an acidic substance or an alkaline substance is extennally added;

(4) ammonium-exchanging the product of step (3).

6. The process according to claim 5, wherein

the rare-earth salt solution is selected from an aqueous solution of one of or two or more of lanthanum chloride, cerium chloride, praseodymium chloride, and neodymium chloride;

the ammonium salt solution is selected from one of or a mixture of two or more of ammonium chloride solution, ammonium nitrate solution, ammonium carbonate solution and ammonium bicarbonate solution.

7. The process according to any of claims 5-6, wherein the contacting of the molecular sieve and a rare-earth salt solution or a mixed solution of rare-earth salt solution and ammonium salt is performed at a pH of 3.0-5.0 at a weight ratio of water to molecular sieve of 5-30 at room temperature to 100°C (for example 40-90°C).

8. The process according to any of claims 5-7, wherein in said rare earth

containing molecular sieve, as rare earth oxide, the rare earth content is 1-20 wt%, preferably 8-15 wt%, the unit cell constant is 2.440-2.470 nm, and the crystallinity is 30-60%.

9. The process according to any of claims 5-8, wherein, said inorganic oxide binder is at least one selected from silica sol, alumina sol, peptized pseudo-boehmite, silica alumina sol and phosphorus-containing alumina sol;

preferably, said peptized pseudo-boehmite is obtained by mixing pseudo-boehmite and water, slurrying to form a slurry, and adding hydrochloric acid into the slurry for acidification, the weight ratio of said hydrochloric acid to pseudo-boehmite on the dry basis is 0.05-0.50;

more preferably, said inorganic oxide binder is pseudo-boehmite and alumina sol, preferably in a weight ratio of (0.1-2):1.

10. The process according to any of claims 5-9, wherein said natural mineral is at least one selected from kaolin, halloysite, montmorillonite, diatomite, attapulgite, sepiolite, keramite, hydrotalcite, bentonite and rectorite.

11. The process according to any of claims 5-10, wherein said shaping is pelleting by spray-drying.

12. The process according to any of claims 5-11, wherein

the acidic substance is one of or a mixture of two or more of ammonium chloride, ammonium sulfate, ammonium carbonate, ammonium bicarbonate, ammonium carbonate, ammonium phosphate, ammonium dihydrogen phosphate, diammonium hydrogen phosphate, hydrochloric acid, sulfuric acid and nitric acid; and

the alkaline substance is selected from one of or a mixture of two or more of ammonia water, a buffer solution of ammonia water and ammonium chloride, sodium hydroxide, sodium carbonate, and sodium bicarbonate;

the gauge pressure of the atmosphere condition is 0.01-1.0 MPa, for example 0.1-0.8 MPa, preferably 0.3-0.6 MPa;

the atmosphere condition contains 1-100% water vapor, for example 30%-100%

water vapor, preferably 60-100% water vapor;

the treatment of hydrothermally calcining is performed at 300-800°C, preferably 400-600°C.

13. The process according to any of claims 5-12, wherein said raw materials further include ZSM-5 molecular sieve.

14. A system for preparing the catalytic cracking catalyst according to any of claims 1-4, which is characterized in that said system is mainly composed of a molecular sieve (e.g. NaY molecular sieve)-rare earth exchanging device, a raw material mixing device, a shaping device, and a pressurized hydrothermal calcining device,

wherein,

the molecular sieve-rare earth exchanging device comprises an equipment for introducing the rare-earth salt solution or an equipment for introducing the rare-earth salt solution and the ammonium salt solution, and a filtering equipment and a water-washing equipment;

said raw material mixing device receives the catalyst raw materials including a rare earth-containing molecular sieve obtained from the molecular sieve-rare earth exchanging device, and an inorganic oxide binder from the inorganic oxide binder-treating device;

said shaping device is a device of shaping by spray-drying; and

said pressurized hydrothermal calcining device is provided with an inlet of the aqueous solution containing an acidic substance or an alkaline substance, and a gas pressurization joint.