Claims

1. A rare earth-containing Y zeolite, having at least two mesopore pore-size distributions at 2-3 nanometers and 3-4 nanometers.

2. The zeolite according to claim 1, wherein the mesopore volume of the zeolite is 0.031 cc/g to 0.037cc/g.

3. The zeolite according to claim 1 or 2, wherein the ratio of the intensity I1 of the peak at $2\theta=11.8\pm0.1°$ to the intensity I2 of the peak at $2\theta=12.3\pm0.1°$ in the X-ray diffraction pattern is ≥ 4.0, preferably 4.5-6.0, for example≥ 4.8, or 4.9-7.0.

4. The zeolite of any of the previous claims, wherein in a BJH pore-size distribution curve of the zeolite, the ratio of the peak area for the pore-size distribution at 2-3 nanometers to the peak area for the pore-size distribution at 3-4 nanometers is ≥0.05, preferably ≥0.1, more preferably 0.1-0.4.

5. The zeolite according to any of the previous claims, which has a rare-earth content as rare-earth oxide of 2-18 wt%, preferably 8-15 wt%, a unit cell constant of 2.440-2.470 nm, and a crystallinity of 30-60%.

6. The zeolite according to any of the previous claims, wherein

in a BJH pore-size distribution curve of the zeolite, a mesopore pore-size distribution at 10-30 nanometers is present, wherein the ratio of the peak area for the pore-size distribution at 2-3 nanometers to the peak area of the total pores is greater than 0.1, for example, greater than 0.12, greater than 0.15, more preferably 0.18-0.26;

the ratio of the peak area for the pore-size distribution at 10-30 nanometers to the peak area of the total pores is greater than 0.2, for example, greater than 0.22, greater than 0.25, more preferably 0.27-0.32.

7. A process for preparing the rare earth-containing Y zeolites according to any of claims 1-6, which comprises a step of hydrothermally calcining the rare earth-containing NaY zeolite in an atmosphere condition where an external pressure is applied and water is externally added, for the atmosphere condition, the gauge pressure is 0.01-1.0 MPa, for example 0.1-0.8 MPa, preferably 0.3-0.6 MPa, and the atmosphere contains 1-100% water vapor, for example 30%-100% water vapor, preferably 60-100% water vapor.

8. The process according to claim 7, wherein said rare earth-containing NaY zeolite is obtained from step A of contacting a NaY zeolite with a rare-earth salt solution or a mixed solution of rare-earth salt solution and ammonium salt.

9. The process according to claim 7, wherein the rare earth-containing NaY zeolite is obtained through the following steps (1) and (2):

(1) partially ammonium-exchanging of a NaY zeolite with an ammonium salt to remove 10-80% sodium ions, filtering, washing, and drying to obtain a NH4NaY zeolite;

(2) contacting the NH4NaY zeolite obtained in step (1) with a rare-earth salt solution or a mixed solution of rare-earth salt solution and ammonium salt, and then filtering, water washing and drying to produce the rare earth-containing NaY zeolite.

10. The process according to any of claims 7-9, wherein the atmosphere condition of the water is an atmosphere condition of pure water or an atmosphere condition of an aqueous solution containing an acidic substance or an alkaline substance.

11. The process according to any of claims 8-10, wherein

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

the ammonium salt is selected from ammonium chloride, ammonium nitrate, ammonium carbonate and ammonium bicarbonate or any mixture thereof.

12. The process according to any of claims 8-11, wherein step A or step (2) is carried out at pH=3.0 to 5.0, at the weight ratio of water/zeolite of 5 to 30, and at room temperature to 100°C, optionally, the exchanging time is at least 0.3 hours.

13. The process according to any of claims 7-12, wherein for said atmosphere condition, the gauge pressure is preferably 0.1 to 0.8 MPa, more preferably 0.3 to 0.6 MPa, and the atmosphere contains 30% to 100% water vapor, preferably 60 to 100% water vapor.

14. The process according to any of claims 7-13, wherein the step of hydrothermal calcining is performed at 300-800°C, preferably 400-600°C.

15. The process according to any of claims 7-14, wherein the atmosphere condition of the water is an atmosphere condition of an aqueous solution containing an acidic substance or an alkaline substance, the acidic substance is selected from ammonium chloride, ammonium sulfate, ammonium carbonate, ammonium bicarbonate, ammonium phosphate, ammonium dihydrogen phosphate, diammonium phosphate, hydrochloric acid, sulfuric acid, nitric acid, and any mixture thereof; the alkaline substance includes one or more of ammonia water, buffer solution of ammonia water and ammonium chloride, sodium hydroxide, sodium metalluminate, sodium carbonate, sodium bicarbonate, or any mixture thereof.

16. The process according to any of claims 10-15, wherein the mass concentration of the aqueous solution containing the acidic substance or the alkaline substance is 0.1-20%.

17. A catalytic cracking catalyst, wherein the catalytic cracking catalyst contains 20-60wt% of the rare earth-containing Y zeolite according to any of claims 1-6, 10-30wt% of inorganic oxide binder and 30-50wt% of natural mineral.

18. The catalytic cracking catalyst according to claim 17, wherein said natural mineral is at least one selected from kaolin, halloysite, montmorillonite, diatomite, attapulgite, sepiolite, keramite, hydrotalcite, bentonite and rectorite, and the inorganic oxide binder is at least one selected from silica sol, alumina sol, peptized pseudo-boehmite, silica alumina sol and phosphorus-containing alumina sol.