CLAIMS

[Claim 1] A hydrodesulfurization catalyst for a hydrocarbon oil comprising at least one type of metal component selected from Groups VIA and VIII in the periodic table, supported on a silica-titania-alumina support where the total of the diffraction peak area indicating the crystal structure of anatase titania (101) planes and the diffraction peak area indicating the crystal structure of rutile titania (110) planes is 1/4 or less of the diffraction peak area indicating the aluminum crystal structure ascribed to γ-alumina (400) planes, as measured by X-ray diffraction analysis, the catalyst having (a) a specific surface area (SA) of 150 m^2/g or greater, (b) a total pore volume (PVo) of 0.30 ml/g or greater, (c) an average pore diameter (PD) of 6 to 15 nm (60 to 150 Å), and (d) the ratio of the pore volume (PVp) of pores having diameters within ±30 percent of the average pore diameter (PD) being 70 percent or greater of the total pore volume (PVo).

[Claim 2] The hydrodesulfurization catalyst for a hydrocarbon oil according to claim 1, wherein said silica-titania-alumina support contains silica in the form of SiO_2 in an amount of 1 to 10 percent by mass, titania in the form of TiO_2 in an amount of 3 to 40 percent

by mass, and alumina in the form of Al_2O_3 in an amount of 50 to 96 percent by mass, all on the support basis.

[Claim 3] The hydrodesulfurization catalyst for a hydrocarbon oil according to claim 1 or 2, wherein said metal component selected from Groups VIA and VIII in the periodic table is selected from the group consisting of molybdenum, tungsten, cobalt, and nickel.

[Claim 4] The hydrodesulfurization catalyst for a hydrocarbon oil according to any one of claims 1 to 3, wherein said metal component selected from Groups VIA and VIII in the periodic table is supported in an amount of 1 to 35 percent by mass in the form of oxide on the catalyst basis.

[Claim 5] A process of producing the catalyst according any one of claims 1 to 4, comprising:

a first step of producing a hydrate by mixing a basic aluminum salt aqueous solution and a mixed aqueous solution of a titanium mineral acid salt and an acidic aluminum salt such that the pH is form 6.5 to 9.5;

a second step of producing a support by in turn washing, extruding, drying and calcining the hydrate; and

a third step of loading at least one type of metal

component selected from Groups VIA and VIII in the periodic table, on the support.

[Claim 6] A method for hydrorefining a hydrocarbon oil wherein a hydrocarbon oil is hydrotreated under a hydrogen atmosphere using the hydrodesulfurization catalyst according any one of claims 1 to 4.

[Claim 7] The method for hydrorefining a hydrocarbon oil according to claim 6, wherein said hydrotreatment is carried out at a reaction temperature of 300 to 420°C, a hydrogen partial pressure of 3.0 to 15.0 MPa, a liquid hourly space velocity of 0.5 to 4.0 h^{-1}, and a hydrogen/oil ratio of 120 to 420 NL/L.

[Claim 8] The method for hydrorefining a hydrocarbon oil according to claim 6 or 7, wherein said hydrocarbon oil is selected from the group consisting of straight-run gas oil, vacuum gas oil, light cycle oil, hydrocracked gas oil, and thermal cracked gas oil.

[Claim 9] The method for hydrorefining a hydrocarbon oil according to any one of claims 6 to 8, wherein said hydrocarbon oil contains 70 percent by volume or more of a fraction having a boiling point of 260 to 360°C.

[Claim 10] The method for hydrorefining a hydrocarbon oil according to any one of claims 6 to 9,

wherein the oil produced by hydrotreatment of said hydrocarbon oil contains sulfur in an amount of 10 ppm by mass or less and nitrogen in an amount of 3 ppm by mass or less.

CLAIMS

1. A hydrodesulfurization catalyst for a hydrocarbon oil comprising at least one type of metal component selected from Groups VIA and VIII in the periodic table, supported on a silica-titania-alumina support where the total of the diffraction peak area indicating the crystal structure of anatase titania (101) planes and the diffraction peak area indicating the crystal structure of rutile titania (110) planes is 1/4 or less of the diffraction peak area indicating the aluminum crystal structure ascribed to γ-alumina (400) planes, as measured by X-ray diffraction analysis, the catalyst having (a) a specific surface area (SA) of 150 m^2/g or greater, (b) a total pore volume (PVo) of 0.30 ml/g or greater, (c) an average pore diameter (PD) of 6 to 15 nm (60 to 150 Å), and (d) the ratio of the pore volume (PVp) of pores having diameters within±30 percent of the average pore diameter (PD) being 70 percent or greater of the total pore volume (PVo), wherein said silica-titania-alumina support contains silica in the form of SiO_2 in an amount of 1 to 10 percent by mass, titania in the form of TiO_2 in an amount of 15 to 35 percent by mass, and alumina in the form of Al_2O_3 in an amount of 55 to 84 percent by mass, all on the support basis.

2. The hydrodesulfurization catalyst for a hydrocarbon oil according to claim 1, wherein said metal component selected from Groups VIA and VIII in the periodic table is selected from the group consisting of molybdeum, tungasten, cobalt, and nickel.

3. The hydrodesulfurization catalyst for a hydrocarbon oil according to claim 1, wherein said metal component selected from Groups VIA and VIII in the periodic table is supported in an amount of 1 to 35 percent by mass in the form of oxide on the catalyst basis.

4. The hydrodesulfurization catalyst for a hydrocarbon oil according to claim 1, wherein the total of the diffraction peak area indicating the crystal structure of anatase titania (101) planes and the diffraction peak area indicating the crystal structure of rutile titania (110) planes is less than 1/5 of the diffraction peak area indicating the aluminum crystal structure ascribed to γ-alumina (400) planes.

5. A method for hydrorefining a hydrocarbon oil wherein a hydrocarbon oil is hydrotreated under a hydrogen atmosphere using the hydrodesulfurization catalyst according to claim 1.

6. The method for hydrorefining a hydrocarbon oil according to claim 5, wherein said hydrotreatment is carried out at a reaction temperature of 300 to 420 ℃., a hydrogen partial pressure of 3.0 to 15.0 Mpa, a liquid hourly space velocity of 0.5 to 4.0h^{-1}, and a hydrogen/oil ratio of 120 to 420 NL/L.

7. The method for hydrorefining a hydrocarbon oil according to claim 5, wherein said hydrocarbon oil is selected from the group consisting of straight-run gas oil, vacuum gas oil, light cycle oil, hydrocracked gas oil, and thermal cracked gas oil.

8. The method for hydrorefining a hydrocarbon oil according to claim 5, wherein said hydrocarbon oil contains 70 percent by volume or more of a fraction having a boiling point of 260 to 360 ℃.

9. The method for hydrorefining a hydrocarbon oil according to claim 5, wherein an oil produced by hydrotreatment of said hydrocarbon oil contains sulfur in an amount of 10 ppm by mass or less and nitrogen in an amount of 3 ppm by mass or less.