CLAIMS:

1. A catalyst suitable for the hydrodesulfurization (HDS) of naphtha which is prepared by a process comprising:

(i) heating an alumina precursor to a temperature above at least about 800°C to form a high temperature alumina, impregnating the high temperature alumina with an aqueous solution of (a) a cobalt salt, (b) a molybdenum salt, and (c) at least one organic additive to form an impregnated high temperature alumina, provided that the high temperature alumina has a gamma, eta and chi alumina content less than about 50 wt.%, based on the total weight of the alumina; a median pore diameter in the range of about 100Å to about 1000Å; and a surface area between about 40 m^2/g and about 200 m^2/g;

(ii) drying the impregnated high temperature alumina at temperatures less than about 200°C to form a dried impregnated high temperature alumina catalyst precursor; and

(iii) sulfiding the dried impregnated high temperature alumina catalyst precursor to form a HDS catalyst, provided that the HDS catalyst or catalyst precursor is not calcined prior to sulfiding or use for HDS.

2. A method for making a HDS catalyst, the catalyst prepared by:

(i) heating an alumina precursor to a temperature above at least about 800°C to form a high temperature alumina:

(ii) impregnating the high temperature alumina with an aqueous solution of (a) a cobalt salt, (b) a molybdenum salt, and (c) at least one organic additive to form an impregnated high temperature alumina, provided that the high temperature alumina has a gamma, eta and chi alumina content less than about 50 wt.%, based on the total weight of the alumina; a median pore diameter in the range of about

100Å to about 1000Å; and a surface area between about 40 m^2/g and about 200 m^2/g;

(iii) drying the impregnated high temperature alumina at temperatures less than about 200°C to form a dried impregnated high temperature alumina catalyst precursor; and

(iv) sulfiding the dried impregnated high temperature alumina catalyst precursor to form a HDS catalyst, provided that the HDS catalyst or catalyst precursor is not calcined prior to sulfiding or use for HDS.

3. A method for the HDS of a naphtha having an olefin content of at least about 5 wt.%, based on the weight of the naphtha comprising:

(i) contacting the naphtha with a HDS catalyst under hydrodesulfurization conditions, wherein the catalyst is prepared by heating an alumina precursor to a temperature above at least about 800°C to form a high temperature alumina, impregnating the high temperature alumina with an aqueous solution of (a) a cobalt salt, (b) a molybdenum salt, and (c) at least one organic additive to form an impregnated high temperature alumina, provided that the high temperature alumina has a gamma, eta and chi alumina content less than 50 wt.%, based on the total weight of the alumina; a median pore diameter in the range of about 100Å to about 1000Å; and a surface area between about 40 m^2/g and about 200 m^2/g;

(ii) drying the impregnated high temperature alumina at temperatures less than about 200°C to form a dried impregnated high temperature alumina catalyst precursor; and

(iii) sulfiding the dried impregnated high temperature alumina catalyst precursor to form a HDS catalyst, provided that the HDS catalyst or catalyst precursor is not calcined prior to sulfiding or use for HDS.

4. The methods of claims 1, 2 or 3 wherein the high temperature alumina comprises at least one of theta, delta, kappa and alpha alumina.

5. The method of claim 4 wherein the amount of high temperature alumina is greater than about 70 wt.%, based on total alumina.

6. The method of claim 5 wherein the amount of high temperature alumina is greater than about 80 wt.%, based on total alumina.

7. The method of claims 1, 2 or 3 wherein the median pore diameter is from about 150Å to about 1000Å.

8. The method of claims 1, 2 or 3 wherein the pore volumes are in the range from about 0.3 cc/g to about 1.5 cc/g.

9. The method of claims 1, 2 or 3 wherein the surface areas are between about 40 m^2/g and about 150 m^2/g.

10. The method of claim 3 wherein the naphtha has an olefin content from about 5 wt.% to about 60 wt.%, nitrogen content of from about 5 ppmw to about 500 ppmw and sulfur content from about 300 ppmw to about 7000 ppmw, based on naphtha.

11. The method of claims 1, 2 or 3 wherein the amounts of cobalt salt and molybdenum salts are sufficient to provide a catalyst support containing

from about 1 wt.% to about 8 wt.% cobalt and about 6 wt.% to 20 wt.% molybdenum, based on alumina support.

12. The methods of claims 1, 2 or 3 wherein the organic additive is an organic ligand.

13. The method of claim 12 wherein the organic ligand is a mono-dentate, bi-dentate or poly-dentate ligand.

14. The method of claim 13 wherein the organic ligand is at least one carboxylic acid, polyol, amino acid, amine, amide, amino alcohol, ketone or ester.

15. The method of claim 14 wherein the organic ligand is at least one of phenanthroline, quinolinol, salicylic acid, acetic acid, ethylenediaminetetraacetic acid (EDTA), cyclohexanediaminetetraacetic acid (CYDTA), alanine, arginine, triethanolamine (TEA), glycerol, histidine, acetylacetonate, guanidine, nitrilotriacetic acid (NTA), citric acid or urea.

16. The method of claims 1, 2 or 3 wherein the catalyst precursor is dried at temperatures of from about 50 °C to about 200°C.

17. The method of claims 1, 2 or 3 wherein sulfiding of catalyst precursor may be in-situ or ex-situ in the presence of at least one sulfiding agent.

18. The method of claim 17 wherein the sulfiding agent is hydrogen sulfide at concentrations of from about 0.1 vol.% to about 10 vol.%, based on total volume of gases present.

19. The method of claim 3 wherein hydrodesulfurizing conditions include temperatures of from about 150°C to about 400°C, pressures of from about 445 kPa to about 13890 kPa (50 to 2000 psig), liquid hourly space velocities of from about 0.1 to 12 and hydrogen treat gas rates of from about 89 m^3/m^3 to about 890 m^3/m^3 (500 to 5000 scf/B).

20. The method of claims 1, 2 or 3 wherein the dried catalyst precursor or sulfided catalyst is not heated to temperatures greater than about 300°C prior to sulfiding or use for HDS.

CLAIMS

1. A catalyst for the hydrodesulfurization (HDS) of naphtha which is prepared by a process comprising:

(i) heating an alumina precursor to a temperature above at least about 800°C to form a high temperature alumina, impregnating the high temperature alumina with an aqueous solution of (a) a cobalt salt, (b) a molybdenum salt, and (c) at least one organic additive to form an impregnated high temperature alumina, provided that the high temperature alumina has a gamma, eta and chi alumina content less than about 30 wt.%, based on the total weight of the alumina; a median pore diameter in the range of about 100Å to about 1000Å; and a surface area between about 40 m^2/g and about 200 m^2/g;

(ii) drying the impregnated high temperature alumina at temperatures less than about 200°C to form a dried impregnated high temperature alumina catalyst precursor; and

(iii) sulfiding the dried impregnated high temperature alumina catalyst precursor to form a HDS catalyst, provided that the HDS catalyst or catalyst precursor is not calcined prior to sulfiding or use for HDS;

wherein the organic additive is an organic ligand containing oxygen and/or nitrogen atoms.

2. The catalyst of claim 1 wherein the high temperature alumina comprises at least one of theta, delta, kappa and alpha alumina.

3. The catalyst of claim 2 wherein the amount of high temperature alumina is greater than about 70 wt.%, based on total alumina.

4. The catalyst of claim 3 wherein the amount of high temperature alumina is greater than about 80 wt.%, based on total alumina.

5. The catalyst of claim 1 wherein the median pore diameter is from about 150Å to about 1000Å.

6. The catalyst of claim 1 wherein the pore volumes are in the range from about 0.3 cc/g to about 1.5 cc/g.

7. The catalyst of claim 1 wherein the surface areas are between about 40 m^2/g and about 150 m^2/g.

8. The catalyst of claim 1 wherein the amounts of cobalt salt and molybdenum salts are sufficient to provide a catalyst support containing from about 1 wt.% to about 8 wt.% cobalt

and about 6 wt.% to 20 wt.% molybdenum, based on alumina support.

9. The catalyst of claim 1 wherein the organic ligand is a mono-dentate, bi-dentate or poly-dentate ligand.

10. The catalyst of claim 9 wherein the organic ligand is at least one carboxylic acid, polyol, amino acid, amine, amide, amino alcohol, ketone or ester.

11. The catalyst of claim 10 wherein the organic ligand is at least one of phenanthroline, quinolinol, salicylic acid, acetic acid, ethylenediaminetetraacetic acid (EDTA), cyclohexanediaminetetraacetic acid (CYDTA), alanine, arginine, triethanolamine (TEA), glycerol, histidine, acetylacetonate, guanidine, nitrilotriacetic acid (NTA), citric acid or urea.

12. The catalyst of claim 1 wherein the catalyst precursor is dried at temperatures of from about 50°C to about 200°C.

13. The catalyst of claim 1 wherein sulfiding of catalyst precursor may be in-situ or ex-situ in the presence of at least one sulfiding agent.

14. The catalyst of claim 13 wherein the sulfiding agent is hydrogen sulfide at concentrations of from about 0.1 vol.% to about 10 vol.%, based on total volume of gases present.

15. The catalyst of claim 1 wherein the dried catalyst precursor or sulfided catalyst is not heated to temperatures greater than about 300°C prior to sulfiding or use for HDS.

16. A method for making the hydrodesulfurization (HRS) catalyst of claim 1, the method comprising the steps of:

(i) heating an alumina precursor to a temperature above at least about 800°C to form a high temperature alumina;

(ii) impregnating the high temperature alumina with an aqueous solution of (a) a cobalt salt, (b) a molybdenum salt, and (c) at least one organic additive to form an impregnated high temperature alumina, provided that the high temperature alumina has a gamma, eta and chi alumina content less than about 30 wt.%, based on the total weight of the alumina; a median pore diameter in the range of about 100Å to about 1000Å; and a surface area between about 40 m^2/g and about 200 m^2/g;

(iii) drying the impregnated high temperature alumina at temperatures less than about 200°C to form a dried impregnated high temperature alumina catalyst precursor; and

(iv) sulfiding the dried impregnated high temperature alumina catalyst precursor to form a HDS catalyst, provided that the HDS catalyst or catalyst precursor is not calcined prior to sulfiding or use for HDS;

wherein the organic additive is an organic ligand containing oxygen and/or nitrogen atoms.

17. The method of claim 16 wherein the high temperature alumina comprises at least one of theta, delta, kappa and alpha alumina.

18. The method of claim 17 wherein the amount of high temperature alumina is greater than about 70 wt.%, based on total alumina.

19. The method of claim 18 wherein the amount of high temperature alumina is greater than about 80 wt.%, based on total alumina.

20. The method of claim 16 wherein the median pore diameter is from about 150Å to about 1000Å.

21. The method of claim 16 wherein the pore volumes are in the range from about 0.3 cc/g to about 1.5 cc/g.

22. The method of claim 16 wherein the surface areas are between about 40 m^2/g and about 150 m^2/g.

23. The method of claim 16 wherein the amounts of cobalt salt and molybdenum salts are sufficient to provide a catalyst support containing from about 1 wt.% to about 8 wt.% cobalt and about 6 wt.% to 20 wt.% molybdenum, based on alumina support.

24. The method of claim 16 wherein the organic ligand is a mono-dentate, bi-dentate or poly-dentate ligand.

25. The method of claim 24 wherein the organic ligand is at least one carboxylic acid, polyol, amino acid, amine, amide, amino alcohol, ketone or ester.

26. The method of claim 25 wherein the organic ligand is at least one of phenanthroline, quinolinol, salicylic acid, acetic acid, ethylenediaminetetraacetic acid (EDTA), cyclohexanediaminetetraacetic acid (CYDTA), alanine, arginine, triethanolamine (TEA), glycerol, histidine, acetylacetonate, guanidine, nitrilotriacetic acid (NTA), citric acid or urea.

27. The method of claim 16 wherein the catalyst precursor is dried at temperatures of from about 50°C to about 200°C.

28. The method of claim 16 wherein sulfiding of catalyst precursor may be in-situ or ex-situ in the presence of at least one sulfiding agent.

29. The method of claim 28 wherein the sulfiding agent is hydrogen sulfide at concentrations of from about 0.1 vol.% to about 10 vol.%, based on total volume of gases present.

30. The method of claim 16 wherein the dried catalyst precursor or sulfided catalyst is not heated to temperatures greater than about 300°C prior to sulfiding or use for HDS.