CLAIMS:

1. A supported catalyst comprising at least one metal from Group 6, alternatively referred to as Group VIB, of the Periodic Table of the Elements, at least one metal from Groups 8, 9 or 10, alternatively referred to as Group VIIIB, of the Periodic Table of the Elements, and optionally comprising phosphorous;

wherein the Group 6 metal comprises 30 wt.% to 45 wt.% and the total of Group 6 and Group 8, 9 or 10 or mixtures thereof metal components comprise 35 wt.% to 55 wt.%, calculated as oxides and based on the total weight of the catalyst composition;

wherein the metals, and phosphorous when present, are carried on and/or within a porous inorganic oxide carrier or support, the support prior to incorporation of the metals and phosphorus when present, having a total pore volume (TPV) of 0.8 cc/g to 1.5 cc/g and comprising:

(a) equal to or greater than 25 % to 45 % of TPV in pores having a diameter of 100 Angstroms (Å) (10 nm) to 200 Å (20 nm);

(b) greater than 15 % to less than 30 % of TPV in pores having a diameter of 200 Å (20 nm) to less than 1000 Å (100 nm);

(c) equal to or greater than 10 % to less than 30 % of TPV in pores having a diameter of 1000 Å (100 nm) to 30,000 Å (3,000 nm); and

(d) wherein the supported catalyst comprises:

(e) equal to or greater than 35 % to 60 % of TPV in pores having a diameter of 100 Å (10 nm) to 200 Å (20 nm);

(f) greater than 15 % to less than 30 % of TPV in pores having a diameter of 200 Å (20 nm) to less than 1000 Å (100 nm);

(g) equal to or greater than 10 % to less than 30 % of TPV in pores having a diameter of 1000 Å (100 nm) to 30,000 Å (3,000 nm); and

wherein pore properties and contents are measured using mercury porosimetry.

2. The supported catalyst of claim 1, wherein the support exhibits a d_{50} equal to or greater than 110 Å (11 nm) and equal to or less than 170 Å (17 nm), or the supported catalyst exhibits a d50 equal to or greater than 125 Å (12.5 nm) and equal to or less than 210 Å (21 nm).

3. The supported catalyst of claim 1 or 2, wherein greater than 17 % to less than 28 % of TPV of the supported catalyst is in pores having a diameter of 200 Å to less than 1000 Å.

4. The supported catalyst of any one of claims 1-3, wherein equal to or greater than 12 % to less than 28 % of the TPV of the supported catalyst is in pores having a diameter of 1000 Å (100 nm) to 30,000 Å (3,000 nm).

5. The supported catalyst of claim 4, wherein equal to or greater than 15 % to less than 25 % of the TPV is in pores having a diameter of 1000 Å (100 nm) to 30,000 Å (3,000 nm).

6. The supported catalyst of any one of claims 1-5, wherein 40 % to 55 % of the TPV is in pores having a diameter of 100 Å (10 nm) to 200 Å (20 nm).

7. The supported catalyst of any one of claims 1-6, wherein the support is silica, silica gel, silica-alumina, alumina, alumina with silica-alumina dispersed therein, alumina-coated silica, silica-coated alumina, titania, titania-alumina, zirconia, boria, terrana, kaolin, magnesium silicate, magnesium carbonate, magnesium oxide, aluminum oxide, precipitated aluminum oxide, activated alumina, bauxite, kieselguhr, pumice, natural clay, synthetic clay, cationic clay, anionic clay, or a mixture of any two or more thereof.

8. The supported catalyst of any one of claims 1-7, wherein the metal of Group 6 is Mo, and the metal of Group 8, 9, or 10 is selected from the group consisting of Co, Ni, and mixtures thereof.

9. The supported catalyst of claim 8 further comprising phosphorous.

10. The supported catalyst of claim 1 useful in at least one process that is:
hydroprocessing a petroleum feedstock;
hydrocracking (HCR) of a petroleum feedstock;
hydrodearomatization (HDA) of a petroleum feedstock;

hydrodesulfurization (HDS) of a petroleum feedstock;

hydrodenitrification (HDN) of a petroleum feedstock;

hydrodemetallation (HDM) of a petroleum feedstock; or

hydrotreating of a charged hydrocarbon feed or petroleum feedstock containing components boiling above 600 ºF (315.6°C), and at least one component components selected from the group consisting of sulfur-containing compounds, nitrogen-containing compounds, metal-containing compounds, asphaltenes, carbon residue, sediment precursors, and mixtures thereof.

11. The supported catalyst of claim 10, wherein the catalyst has been pre-impregnated, shaped, dried and calcined.

12. The supported catalyst of claim 10 or 11, wherein the catalyst exhibits a d_{50} equal to or greater than 125 Å (12.5 nm) and equal to or less than 210 Å (21 nm).

13. A process for treating a hydrocarbon feedstock comprising at least one of paraffin, aromatic and naphthene components to produce treated products, the process selected from the group consisting of:

(I) hydrodemetallation, hydrodenitrification, hydrodesulfurization, hydrodearomatization, and hydrocracking, the process comprising contacting the feedstock in at least one reactor with hydrogen under hydroprocessing or hydrocracking conditions with a supported catalyst of claim 1and recovering the product;

(II) hydrotreating the hydrocarbon feed containing components boiling above 1000º F, and at least one component selected from the group consisting of sulfur-containing compounds, nitrogen-containing compounds, metal-containing compounds, asphaltenes, carbon residue, sediment precursors, and mixtures thereof, comprising contacting the feed with hydrogen and a supported catalyst of claim 1 at isothermal or substantially isothermal hydrotreating conditions and recovering the treated product;

(III) hydroconverting the hydrocarbon feed having components exhibiting a boiling point greater than 600° F (315.6°C) to form product having an increased proportion of components exhibiting a boiling point less than 600°F (315.6°C) comprising contacting the feed

with hydrogen and a supported catalyst of claim 1 at isothermal or substantially isothermal hydrotreating conditions and recovering the product; and

(IV) hydroconverting the feed, comprising contacting the feed comprising a hydrocarbon oil with hydrogen and a supported catalyst of claim 1 under conditions of elevated temperature above 600° F (315.6°C) and pressure above 500 p.s.i.g. (3.44 MPa) and recovering the product.

14. The process of claim 13, wherein the recovered product following treatment exhibits at least one of a reduced content of aromatic components, increased content of paraffinic components, reduced viscosity and increased viscosity index compared to the untreated hydrocarbon feedstock.

15. A method for preparing a catalyst for use in at least one process selected from the group consisting of:

(I) hydroprocessing a petroleum feed;

(II) hydrocracking (HCR) of a petroleum feedstock;

(III) hydrodesulfurization of hydrocarbons;

(IV) hydrodenitrification of hydrocarbons;

(V) hydrodearomatization (HDA) of a petroleum feedstock;

(VI) hydrodemetallation of hydrocarbons; and

(VII) hydrotreating a charge hydrocarbon feed containing components boiling above 600 °F (315.6°C), and at least one component selected from the group consisting of sulfur-containing compounds, nitrogen-containing compounds, metal-containing compounds, asphaltenes, carbon residue, sediment precursors, and mixtures thereof;

the method comprising impregnating a porous inorganic oxide support with an aqueous solution comprising at least one catalytic agent or catalytic agent precursor selected from the group consisting of compounds of Group 6, alternatively referred to as Group VIB, of the Periodic Table of the Elements, and at least one catalytic agent or catalytic agent precursor selected from the group consisting of compounds of Groups 8, 9 or 10, alternatively referred to as Group VIII, of the Periodic Table of the Elements, and optionally comprising a phosphorous-containing compound and at least one organic chelating compound, the Group VIB and Group

VIIIB and phosphorus compounds being thermally decomposable or oxidizable in the presence of an oxygen-containing atmosphere to their corresponding oxides and thereafter drying and calcining the resulting impregnated support, the support having been prepared by:

mixing alumina-containing powder with water and optionally nitric acid to form a damp mix;

shaping the damp mix so as to form support particles suitable for use in a hydroprocessing reactor; and

the porous inorganic oxide support comprising a porous inorganic oxide having a total pore volume (TPV) of 0.8 cc/g to 1.5 cc/g and, prior to incorporation of the metals and phosphorus when present having the following pore size distribution and pore content corresponding to values as measured using mercury porosimetry:

equal to or greater than 25 % to 45 % of TPV in pores having a diameter of 100 Å (10 nm) to 200 Å (20 nm);

greater than 15 % to less than 30 % of TPV in pores having a diameter of 200 Å (20 nm) to less than 1000 Å (100 nm); and

equal to or greater than 10 % to less than 29.9 % of the pore volume in pores having a diameter of 1000 Å (100 nm) to 30,000 Å (3,000 nm).

16. The method of claim 15 further comprising after shaping, drying and calcining the support particles to form calcined pills.

17. The method of claim 15 or 16, wherein the aqueous solution contains an organic chelating compound that is acetic acid, citric acid, tartaric acid, oxalic acid, maleic acid, malonic acid, malic acid, butanediol, pyruvic aldehyde, glycol aldehyde, acetaldol, tartaric acid, ethylene glycol, propylene glycol, glycerin, trimethylol ethane, trimethylol propane, diethylene glycol, dipropylene glycol, trimethylene glycol, triethylene glycol, tributylene glycol, tetraethylene glycol, tetrapentylene glycol, polyethylene glycol, ethylene glycol monobutyl ether, diethylene glycol monomethyl ether, diethylene glycol monoethyl ether, diethylene glycol monopropyl ether, diethylene glycol monobutyl ether, or a mixture of any two or more thereof.

18. The method of any one of claims 15-17, wherein the organic chelating compound comprises citric acid.

19. The method of any one of claims 15-18, wherein the alumina-containing powder is silica-alumina.

20. A porous inorganic oxide carrier or support, having a total pore volume (TPV) of 0.8 cc/g to 1.5 cc/g and comprising:

equal to or greater than 25 % to 45 % of TPV in pores having a diameter of 100 Angstroms (Å) (10 nm) to 200 Å (20 nm);

greater than 15 % to less than 30 % of TPV in pores having a diameter of 200 Å (20 nm) to less than 1000 Å (100 nm); and

equal to or greater than 10 % to less than 29.9 % of TPV in pores having a diameter of 1000 Å (100 nm) to 30,000 Å (3,000 nm).

21. The porous inorganic oxide carrier or support of claim 20 wherein the support is silica, silica gel, silica-alumina, alumina, alumina with silica-alumina dispersed therein, alumina-coated silica, silica-coated alumina, titania, titania-alumina, zirconia, boria, terrana, kaolin, magnesium silicate, magnesium carbonate, magnesium oxide, aluminum oxide, precipitated aluminum oxide, activated alumina, bauxite, kieselguhr, pumice, natural clay, synthetic clay, cationic clay, anionic clay, or a mixture of any two or more thereof.

22. The porous inorganic oxide carrier or support of any one of claims 20 or 21, wherein the support exhibits a d50 equal to or greater than 110 Å (11 nm) and equal to or less than 170 Å (17 nm).

23. The porous inorganic oxide carrier or support of any one of claims 20-22, having total surface area determined by nitrogen adsorption using the BET technique, of 185 m^2/g up to 425 m^2/g.

24. The porous inorganic oxide carrier or support of any one of claims 20-23, having greater than 55 % to 75 % of pores having diameters of less than 200 Å (20 nm) measured using the mercury penetration method.

25. The porous inorganic oxide carrier or support of any one of claims 20-24, comprising Al_2O_3 and SiO_2 having 85 wt.% to 98 wt.% Al_2O_3 and 15 wt.% to 2 wt.% SiO_2.