What is claimed is:

1. A composition comprising:

an extruded inorganic support comprising an oxide of a metal or metalloid; and

at least one catalytically active Group 10 metal,

wherein the extruded inorganic support has pores, a total pore volume, and a pore size distribution; wherein the pore size distribution displays at least two peaks of pore diameters, each peak having a maximum; wherein a first peak has a first maximum of pore diameters of from about 600 nm to about 6,000 nm and a second peak has a second maximum of pore diameters of less than about 120 nm; wherein greater than or equal to about 15% of a total pore volume of the extruded inorganic support is contained within the first peak of pore diameters; and wherein the composition has a total pore volume of from about 0.1 cc/g to 0.6 cc/g as determined by differential mercury intrusion.

2. The composition of any preceding claim, wherein the oxide of the metal or metalloid consists essentially of silica, titania, alumina, or aluminate.

3. The composition of claim 1, wherein the oxide of the metal or metalloid consists essentially of a spinel.

4. The composition of any preceding claim having a surface area of from about 1 m^2/g to about 35 m^2/g.

5. The composition of any preceding claim wherein the distance between the first maximum of the first peak and the second maximum of the second peak is at least about 400 nm.

6. The composition of any preceding claim wherein the first peak is non-Gaussian and has a peak width at half height that is greater than the peak width at half height of the second peak.

7. The composition of any preceding claim further comprising a halide.

8. The composition of any preceding claim further comprising a Group 1B metal.

9. The composition of any preceding claim further comprising chloride.

10. A method of preparing a hydrogenation catalyst comprising:

extruding a mixture comprising an oxide of a metal or metalloid, a pore former, and water to form an extrudate;

drying the extrudate to form a dried extrudate;

calcining the dried extrudate to from a calcined extrudate;

contacting the calcined extrudate with a chlorine-containing compound to form a chlorided extruded inorganic support;

reducing the amount of chloride in the chlorided extruded inorganic support to form a cleaned chlorided extruded inorganic support; and

contacting the cleaned chlorided extruded inorganic support with a catalytically active Group 10 metal and a Group 1B metal to form a hydrogenation catalyst comprising:

the extruded inorganic support comprising the oxide of the metal or metalloid; and

the catalytically active Group 10 metal and the Group 1B metal,

wherein the extruded inorganic support has pores, a total pore volume, and a pore size distribution; wherein the pore size distribution for the extruded inorganic support displays at least two peaks of pore diameters, each peak having a maximum, and wherein a first peak has a first maximum of pore diameters of from about 600 nm to about 6,000 nm and a second peak has a second maximum of pore diameters that is less than about 120 nm; wherein greater than or equal to about 15% of the total pore volume of the extruded inorganic support is contained within the first peak of pore diameters; and wherein the hydrogenation catalyst has a total pore volume of from about 0.1 cc/g to 0.6 cc/g as determined by differential mercury intrusion

11. The method of claim 10 wherein the calcined extrudate, the chlorided extruded inorganic support, the cleaned chlorided extruded inorganic support, or the hydrogenation catalyst has a surface area of from about 1 m^2/g to about 35 m^2/g.

12. The method of claim 10 or 11 wherein the extrudate consists essentially of silica, titania, alumina, or aluminate.

13. The method of claim 10 or 11 wherein the extrudate consists essentially of alpha alumina.

14. A hydrogenation catalyst comprising: an extruded inorganic support comprising an oxide of a metal or metalloid and at least one catalytically active Group 10 metal, wherein the extruded inorganic support has pores, a total pore volume, and a pore size distribution; wherein the pore size distribution for the extruded inorganic support displays at least two peaks of pore diameters, each peak having a maximum; wherein a first peak has a first maximum of pore diameters of from about about 600 nm to about 6,000 nm and a second peak has a second maximum of pore diameters of less than about 120 nm; wherein greater than or equal to 15% of the total pore volume of the extruded inorganic support is contained within the first peak of pore diameters; wherein the hydrogenation catalyst has a total pore volume of from about 0.1 cc/g to 0.6 cc/g as determine by differential mercury intrusion; and wherein the inorganic support has a surface area of from about 5 m^2/g to about 15 m^2/g.

15. A method of preparing a hydrogenation catalyst comprising:

extruding a mixture comprising an oxide of a metal or a metalloid, a pore former, and water to form an extrudate;

drying the extrudate to form a dried extrudate;

calcining the dried extrudate to from a calcined extruded inorganic support, wherein the calcined extruded inorganic support has pores, a total pore volume, and a pore size distribution; wherein the pore size distribution displays at least two peaks of pore diameters,

each peak having a maximum; wherein a first peak has a first maximum of pore diameters of from about 600 nm to about 6,000 nm and a second peak has a second maximum of pore diameters of less than about 120 nm; wherein greater than or equal to about 15% of the total pore volume of the calcined extruded inorganic support is contained within the first peak of pore diameters; and

contacting the calcined extruded inorganic support with at least one catalytically active Group 10 metal and a Group 1B metal to form a hydrogenation catalyst, wherein the hydrogenation catalyst has a total pore volume of from about 0.1 cc/g to 0.6 cc/g as determined by differential mercury intrustion.

16. The method of claim 15 further comprising contacting the calcined extruded inorganic support with a chlorine-containing compound to form a chlorided extruded inorganic support; contacting the chlorided extruded inorganic support with a wash solution to form a washed chlorided extruded inorganic support; contacting the washed chlorided extruded inorganic support with the catalytically active Group 10 metal and the Group 1B metal to form the hydrogenation catalyst.

17. A method for selectively hydrogenating a highly unsaturated hydrocarbon to a less unsaturated hydrocarbon in an olefin rich hydrocarbon stream comprising introducing into a reactor a hydrocarbon fluid stream comprising a highly unsaturated hydrocarbon in the presence of hydrogen and a catalyst composition under conditions effective to convert the highly unsaturated hydrocarbon to a less unsaturated hydrocarbon,

wherein at least 50% of the catalyst composition comprises the hydrogenation catalyst produced according to claim 15.

18. A method comprising:

preparing a plurality of extruded inorganic supports consisting essentially of silica, titania, alumina, or a spinel, wherein each of the plurality of extruded inorganic supports has pores, a total pore volume, and a pore size distribution;

plotting the pore diameter as a function of a log of differential mercury intrusion for each of the plurality of the extruded inorganic support; and

identifying a first extruded inorganic support having a pore size distribution displaying at least two peaks of pore diameters, each peak having a maximum, wherein a first peak has a first pore diameter maximum of from about 600 nm to about 6,000 nm and a second peak has a second pore diameter maximum of less than about 120 nm, and wherein the first peak of pore diameters represents greater than or equal to about 15% of a total pore volume of the extruded inorganic support; and contacting the first extruded inorganic support with at least one Group 10 metal to form a hydrogenation catalyst; wherein the hydrogenation catalyst has a total pore volume of from about 0.1 cc/g to 0.5 cc/g as determined by differential mercury intrusion.

19. The method of claim 18 further comprising marketing the extruded inorganic supports for use in preparing a selective hydrogenation catalyst.

20. A hydrogenation catalyst comprising a Group 10 metal, a Group 1B metal and at least one of the identified extruded inorganic supports of any preceding claim.

21. A packaged product comprising least one of the identified extruded inorganic supports of any preceding claim and written material describing use of the identified extruded inorganic supports in the preparation of hydrogenation catalysts having a reduced fouling rate.

22. The composition of claim 1 wherein the at least one catalytically active Group 10 metal comprises palladium and the palladium is present in the composition in an amount of from about 0.005 wt.% to about 2 wt.% based on the total weight of the composition.

23. The composition of claim 22 wherein greater than about 90 wt.% of the palladium is concentrated near the periphery of the composition.

24. The hydrogenation catalyst of claim 14 wherein the oxide of the metal or metalloid consists essentially of silica, titania, alumina, or aluminate.

25. The hydrogenation catalyst of claim 14 wherein the extrudate consists essentially of alpha alumina.

CLAIMS

What is claimed is:

1. A composition comprising:
an extruded inorganic support comprising an oxide of a metal or metalloid; and

at least one catalytically active Group 10 metal,

wherein the extruded inorganic support has pores, a total pore volume, and a pore size distribution; wherein the pore size distribution displays at least two peaks of pore diameters, each peak having a maximum; wherein a first peak has a first maximum of pore diameters of from greater than 1,000 nm to about 6,000 nm and a second peak has a second maximum of pore diameters of less than about 120 nm; wherein greater than or equal to about 15% of the total pore volume of the extruded inorganic support is contained within the first peak of pore diameters; and wherein the composition has a total pore volume of from about 0.1 cc/g to 0.6 cc/g as determined by differential mercury intrusion.

2. The composition of claim 1 wherein the oxide of the metal or metalloid consists essentially of silica, titania, alumina, or aluminate.

3. The composition of claim 1 wherein the oxide of the metal or metalloid consists essentially of a spinel.

4. The composition of claim 1 having a surface area of from about 1 m^2/g to about 35 m^2/g.

5. The composition of claim 1 wherein the distance between the first maximum of the first peak and the second maximum of the second peak is up to about 3,900 nm.

6. The composition of claim 1 wherein the first peak is non-Gaussian and has a peak width at half height that is greater than the peak width at half height of the second peak.

7. The composition of claim 1 further comprising a halide.

8. The composition of claim 1 further comprising a Group 1B metal.

9. The composition of claim 1 further comprising chloride.

10. The composition of claim 1 wherein the at least one catalytically active Group 10 metal comprises palladium and the palladium is present in the composition in an amount of from about 0.005 wt. % to about 2 wt. % based on the total weight of the composition.

11. The composition of claim 10 wherein greater than about 90 wt. % of the palladium is concentrated near the periphery of the composition.

12. A method of preparing a hydrogenation catalyst comprising:
extruding a mixture comprising an oxide of a metal or metalloid, a pore former, and water to form an extrudate;

drying the extrudate to form a dried extrudate:

calcining the dried extrudate to form a calcined extrudate;

contacting the calcined extrudate with a chlorine-containing compound to form a chlorided extruded inorganic support;

reducing the amount of chloride in the chlorided extruded inorganic support to form a cleaned chlorided extruded inorganic support; and

contacting the cleaned chlorided extruded inorganic support with a catalytically active Group 10 metal and a Group 1B metal to form a hydrogenation catalyst comprising:
the extruded inorganic support comprising the oxide of the metal or metalloid;

and

the catalytically active Group 10 metal and the Group 1B metal,

wherein the extruded inorganic support has pores, a total pore volume, and a pore size distribution; wherein the pore size distribution for the extruded inorganic support displays at least two peaks of pore diameters, each peak having a maximum, wherein a first peak has a first maximum of pore diameters of from greater than 1,000 nm to about 6,000 nm and a second peak has a second maximum of pore diameters of less than about 120 nm; wherein greater than or equal to about 15% of the total pore volume of the extruded inorganic support is contained within the first peak of pore diameters; and wherein the hydrogenation catalyst has a total pore volume of from about 0.1 cc/g to 0.6 cc/g as determined by differential mercury intrusion.

13. The method of claim 12 wherein the calcined extrudate, the chlorided extruded inorganic support, the cleaned chlorided extruded inorganic support, or the hydrogenation catalyst has a surface area of from about 1 m^2/g to about 35 m^2/g.

14. The method of claim 12 wherein the extrudate consists essentially of silica, titania, alumina, or aluminate.

15. The method of claim 12 wherein the extrudate consists essentially of alpha alumina.

16. A hydrogenation catalyst comprising:
an extruded inorganic support comprising an oxide of a metal or metalloid; and

at least one catalytically active Group 10 metal,

wherein the extruded inorganic support has pores, a total pore volume, and a pore size distribution; wherein the pore size distribution displays at least two peaks of pore diameters, each peak having a maximum;

wherein a first peak has a first maximum of pore diameters of from greater than 1,000 nm to about 6,000 nm and a second peak has a second maximum of pore diameters of less than about 120 nm;

wherein greater than or equal to 15% of the total pore volume of the extruded inorganic support is contained within the first peak of pore diameters; wherein the hydrogenation catalyst has a total pore volume of from about 0.1 cc/g to 0.6 cc/g as determined by differential mercury intrusion; and wherein the inorganic support has a surface area of from about 5 m^2/g to about 15 m^2/g.

17. The hydrogenation catalyst of claim 16 wherein the oxide of the metal or metalloid consists essentially of silica, titania, alumina, or aluminate.

18. The hydrogenation catalyst of claim 16 wherein the extrudate consists essentially of alpha alumina.

19. A method of preparing a hydrogenation catalyst comprising:
extruding a mixture comprising an oxide of a metal or metalloid, a pore former, and water to form an extrudate;

drying the extrudate to form a dried extrudate;

calcining the dried extrudate to from a calcined extruded inorganic support, wherein the calcined extruded inorganic support has pores, a total pore volume, and a pore size distribution; wherein the pore size distribution displays at least two peaks of pore diameters, each peak having a maximum; wherein a first peak has a first maximum of pore diameters of from greater than 1,000 nm to about 6,000 nm and a second peak has a second maximum of pore diameters of less than about 120 nm; wherein greater than or equal to about 15% of the total pore volume of the calcined extruded inorganic support is contained within the first peak of pore diameters; and

contacting the calcined extruded inorganic support with at least one catalytically active Group 10 metal and a Group 1B metal to form a hydrogenation catalyst, wherein the hydrogenation catalyst has a total pore volume of from about 0.1 cc/g to 0.6 cc/g as determined by differential mercury intrusion.

20. The method of claim 19 further comprising contacting the calcined extruded inorganic support with a chlorine-containing compound to form a chlorided extruded inorganic support; contacting the chlorided extruded inorganic support with a wash solution to form a washed chlorided extruded inorganic support; contacting the washed chlorided extruded inorganic support with the catalytically active Group 10 metal and the Group 1B metal to form the hydrogenation catalyst.

21. A method for selectively hydrogenating a highly unsaturated hydrocarbon to a less unsaturated hydrocarbon in an olefin rich hydrocarbon stream comprising introducing into a reactor a hydrocarbon fluid stream comprising a highly unsaturated hydrocarbon in the presence of hydrogen and a catalyst composition under conditions effective to convert the highly unsaturated hydrocarbon to a less unsaturated hydrocarbon,
wherein at least 50% of the catalyst composition comprises the hydrogenation catalyst produced according to claim 19.

22. A method comprising:

preparing a plurality of extruded inorganic supports consisting essentially of silica, titania, alumina, or a spinel, wherein each of the plurality of extruded inorganic supports has pores, a total pore volume, and a pure size distribution;

plotting diameter of the pores as a function of a log of differential mercury intrusion for each of the plurality of the extruded inorganic support; and

identifying a first extruded inorganic support having a pore size distribution displaying at least two peaks of pore diameters, each peak having a maximum, wherein a first peak has a first maximum of pore diameters of from greater than 1,000 nm to about 6,000 nm and a second peak has a second maximum of pore diameters of less than about 120 nm, wherein the first peak of pore diameters represents greater than or equal to about 15% of the total pore volume of the first extruded inorganic support; and

contacting the first extended inorganic support with at least one Group 10 metal to form a hydrogenation catalyst; wherein the hydrogenation catalyst has a total pore volume of from about 0.1 cc/g to 0.6 cc/g as determined by differential mercury intrusion.

23. The method of claim 22 further comprising marketing the hydrogenation catalyst.

24. The hydrogenation catalyst produced according to claim 22.