CLAIMS

We claim:

1. A method of preparing a catalyst, comprising:
   (a) adding an inorganic siliceous solid to a column to produce a solid-filled column;
   (b) adding to the solid-filled column a solution comprising titanium tetrachloride and a hydrocarbon solvent to produce a titanium tetrachloride-impregnated solid; and
   (c) calcining the titanium tetrachloride-impregnated solid at a temperature from 500°C to 1000°C to produce the catalyst;
   wherein the inorganic siliceous solid has a pore volume of at least 0.8 cm^3/g.
2. The method of claim 1, wherein the titanium tetrachloride-impregnated solid from step (b) is washed with additional hydrocarbon solvent prior to calcination in step (c).
3. The method of claim 1, wherein the catalyst from step (c) is washed with a C_1-C_4 alcohol to produce an alcohol-washed catalyst.
4. The method of claim 3, wherein the alcohol-washed catalyst is reacted with a silylating agent to produce a silylated catalyst.
5. The method of claim 1, wherein the siliceous solid has a pore volume of at least 2.0 cm^3/g.
6. The method of claim 1, wherein the siliceous solid has a surface area from 25 to 1000 m^2/g.
7. The method of claim 1, wherein the siliceous solid is dried at a temperature from 100°C to 700°C before or after adding the siliceous solid to the column.
8. The method of claim 1, wherein adiabatic temperature changes that occur in step (b) are controlled by adjusting the concentration of titanium tetrachloride in the solution, the rate of addition of the solution to the column, or both.
9. The method of claim 1, wherein the catalyst comprises from 0.5 to 10 wt.%, based on the amount of catalyst, of titanium.
10. The method of claim 1, wherein the hydrocarbon solvent is an aromatic hydrocarbon.
11. A process for forming an epoxide, comprising contacting a solution of an olefin and a peroxide with a catalyst to produce the epoxide, wherein the catalyst is made by a method comprising:
   (a) adding an inorganic siliceous solid to a column to produce a solid-filled column;
   (b) adding to the solid-filled column a solution comprising titanium tetrachloride and a hydrocarbon solvent to produce a titanium tetrachloride-impregnated solid; and

(c) calcining the titanium tetrachloride-impregnated solid at a temperature from 500°C to 1000°C to produce the catalyst;

wherein the inorganic siliceous solid has a pore volume of at least 0.8 cm^3/g.

12. The process of claim 11, wherein the olefin is propylene.

13. The process of claim 11, wherein the peroxide is selected from the group consisting of hydrogen peroxide and organic hydroperoxides.

14. The process of claim 13, wherein the organic hydroperoxide is selected from the group consisting of *tert*-butylhydroperoxide and ethylbenzene hydroperoxide.

15. The process of claim 11, wherein the peroxide conversion is at least 50%.

16. The process of claim 11, wherein peroxide selectivity is greater than 95%.

17. A process for forming an epoxide, comprising contacting a solution of an olefin and a peroxide with a catalyst to produce the epoxide, wherein the catalyst is made by a method comprising:

(a) adding an inorganic siliceous solid to a column to produce a solid-filled column;

(b) adding to the solid-filled column a solution comprising titanium tetrachloride and a hydrocarbon solvent to produce a titanium tetrachloride-impregnated solid; and

(c) calcining the titanium tetrachloride-impregnated solid at a temperature from 500°C to 1000°C to produce the catalyst;

wherein the inorganic siliceous solid has a pore volume of at least 0.8 cm^3/g; and

wherein the peroxide conversion is within the range of 50 to 99% and the peroxide selectivity is greater than 95%.

18. The process of claim 17, wherein the olefin is propylene.

19. The process of claim 17, wherein the peroxide is selected from the group consisting of hydrogen peroxide and organic hydroperoxides.

20. The process of claim 19, wherein the organic hydroperoxide is selected from the group consisting of *tert*-butylhydroperoxide and ethylbenzene hydroperoxide.

We claim:

1. A method of preparing a catalyst, comprising:
   (a) adding an inorganic siliceous solid to a column to produce a solid-filled column;
   (b) adding to the solid-filled column a solution comprising titanium tetrachloride and a hydrocarbon solvent to produce a titanium tetrachloride-impregnated solid; and
   (c) calcining the titanium tetrachloride-impregnated solid at a temperature from 500°C to 1000°C to produce the catalyst;
   wherein the inorganic siliceous solid has a pore volume of at least 0.8 cm^3/g.
2. The method of claim 1, wherein the titanium tetrachloride-impregnated solid from step (b) is washed with additional hydrocarbon solvent prior to calcination in step (c).
3. The method of claim 1, wherein the catalyst from step (c) is washed with a C_1-C_4 alcohol to produce an alcohol-washed catalyst.
4. The method of claim 3, wherein the alcohol-washed catalyst is reacted with a silylating agent to produce a silylated catalyst.
5. The method of claim 1, wherein the siliceous solid has a surface area from 25 to 1000 m^2/g.
6. The method of claim 1, wherein adiabatic temperature changes that occur in step (b) are controlled by adjusting the concentration of titanium tetrachloride in the solution, the rate of addition of the solution to the column, or both.
7. The method of claim 1, wherein the catalyst comprises from 0.5 to 10 wt.%, based on the amount of catalyst, of titanium.
8. A process for forming an epoxide, comprising contacting a solution of an olefin and a peroxide with a catalyst to produce the epoxide, wherein the catalyst is made by a method comprising:
   (a) adding an inorganic siliceous solid to a column to produce a solid-filled column;
   (b) adding to the solid-filled column a solution comprising titanium tetrachloride and a hydrocarbon solvent to produce a titanium tetrachloride-impregnated solid; and
   (c) calcining the titanium tetrachloride-impregnated solid at a temperature from 500°C to 1000°C to produce the catalyst;
   wherein the inorganic siliceous solid has a pore volume of at least 0.8 cm^3/g.
9. The process of claim 8, wherein the olefin is propylene.

10. The process of claim 8, wherein the peroxide is selected from the group consisting of hydrogen peroxide and organic hydroperoxides selected from the group consisting of *tert*-butylhydroperoxide and ethylbenzene hydroperoxide.

11. The process of claim 8, wherein the peroxide conversion is at least 50%.

12. The process of claim 8, wherein peroxide selectivity is greater than 95%.

13. A process for forming an epoxide, comprising contacting a solution of an olefin and a peroxide with a catalyst to produce the epoxide, wherein the catalyst is made by a method comprising:

    (a) adding an inorganic siliceous solid to a column to produce a solid-filled column;

    (b) adding to the solid-filled column a solution comprising titanium tetrachloride and a hydrocarbon solvent to produce a titanium tetrachloride-impregnated solid; and

    (c) calcining the titanium tetrachloride-impregnated solid at a temperature from 500°C to 1000°C to produce the catalyst;

    wherein the inorganic siliceous solid has a pore volume of at least 0.8 cm^3/g; and

    wherein the peroxide conversion is within the range of 50 to 99% and the peroxide selectivity is greater than 95%.

14. The process of claim 13, wherein the olefin is propylene.

15. The process of claim 13, wherein the peroxide is selected from the group consisting of hydrogen peroxide and organic hydroperoxides selected from the group consisting of *tert*-butylhydroperoxide and ethylbenzene hydroperoxide.