CLAIMS

1. A method comprising:

    a) obtaining a solid silica support;

    b) reacting the solid silica support with a silicon alkoxide of the formula:

$$SiX_Y;$$

    wherein:

        each X is independently halide, alkoxylate$_{(C\leq12)}$, alkenyloxylate$_{(C\leq12)}$, alkynyloxylate$_{(C\leq12)}$, aryloxylate$_{(C\leq12)}$, heteroaryloxylate$_{(C\leq12)}$, aralkyloxylate$_{(C\leq12)}$, aralkenyloxylate$_{(C\leq12)}$, heterocycloalkyloxylate$_{(C\leq12)}$, acyloxylate$_{(C\leq12)}$, or a version of any of these groups bearing a net negative charge; and

        Y is equal to the oxidation state of Si; and

    c) depositing titanium from a titanium source on the solid silica support reacted with a silicon alkoxide to form a catalyst in an initial inert gas environment and then in an environment comprising oxygen.

2. The method of claim 1, wherein the solid silica support has an average particle size of 0.7 mm-3.0 mm.

3. The method of claim 1, wherein the solid silica support has a surface area of 300-1100 m^2/g.

4. The method of claim 1, wherein the solid silica support has a pore volume of 0.5-3.0 mL/g.

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5. The method of claim 1, wherein the silicon alkoxide has the formula:

$$SiX_4;$$

wherein:

each X is independently halide, alkoxylate$_{(C\leq12)}$, aralkoxylate$_{(C\leq12)}$, aryloxylate$_{(C\leq12)}$, or a version of any of these groups bearing a negative charge.

6. The method of claim 5, wherein X is selected from the group consisting of methoxylate, ethyoxylate, isopropoxylate and tert-butoxylate.

7. The method of claim 1, wherein the titanium source is selected from the group consisting of titanium trihalide, titanium tetrahalide and titanium tetraalkoxylate.

8. The method of claim 1, wherein titanium deposited from the titanium source comprises 0.1-10% by weight of the catalyst.

9. The method of claim 1, wherein the method further comprises heating the catalyst to a temperature of 250-1000 °C.

10. The method of claim 9, wherein the catalyst is heated for a time period of 0.5-12 hours.

11. The method of claim 1, wherein the inert gas is nitrogen.

12. A method for producing an epoxide comprising:

obtaining a solid silica support;

reacting the solid silica support with a silicon alkoxide of the formula:

$$SiX_Y;$$

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wherein:

each X is independently halide, alkoxylate$_{(C\leq12)}$, alkenyloxylate$_{(C\leq12)}$, alkynyloxylate$_{(C\leq12)}$, aryloxylate$_{(C\leq12)}$, heteroaryloxylate$_{(C\leq12)}$, aralkyloxylate$_{(C\leq12)}$, aralkenyloxylate$_{(C\leq12)}$, heterocycloalkyloxylate$_{(C\leq12)}$, acyloxylate$_{(C\leq12)}$, or a version of any of these groups bearing a net negative charge; and

Y is equal to the oxidation state of Si;

depositing titanium from a titanium source on the solid silica support reacted with a silicon alkoxide to form a catalyst in an initial inert gas environment and then in an environment comprising oxygen; and

contacting the catalyst with an alkene$_{(C\leq20)}$ or aralkene$_{(C\leq20)}$ and a peroxide in a reaction mixture under conditions sufficient to cause olefin epoxidation to produce an epoxide.

13. The method of claim 12, wherein the alkene$_{(C\leq20)}$ is propylene.

14. The method of claim 12, further comprising heating the reaction mixture to a temperature from 50-250 °C.

15. The method of claim 12, wherein the peroxide is selected from the group consisting of tert-butyl hydroperoxide, ethylbenzyl hydroperoxide and cumyl hydroperoxide.

16. The method of claim 12, wherein the epoxidation comprises a molar ratio of peroxide to alkene$_{(C\leq20)}$ from 1:2-1:15.

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17. The method of claim 12, further comprising adding a solvent selected from the group consisting of methanol, ethanol, isopropanol and tert-butanol to the reaction mixture.

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