CLAIMS

1. A method of preparing catalyst for converting diesel type liquid hydrocarbons to methane rich gas, said process comprising the steps of:

   adding stoichiometric amounts of $Ce(NO_3)_3 \cdot 6H_20$, $Gd(NO_3)_3 \cdot 6H_20$, and $Ni(NO_3)_3 \cdot 6H_20$ to de-ionized water to create a dissolved solution;

   adding glycine to the dissolved solution to create a glycine-dissolved solution;

   heating the glycine-dissolved solution such that excess water is evaporated, combustion is initiated, and a catalyst powder is produced;

   calcining the catalyst powder in air at 800ºC for 4 hours;

   activating the catalyst by reducing the catalyst in an environment of hydrogen and nitrogen.

2. The method of claim 1 wherein the catalyst powder is shaped into a form for use in converting diesel type liquid hydrocarbons to methane rich gas.

3. The method of claim 2 wherein the form is catalyst pellets.

4. The method of any of the preceding claims, wherein the molar ratio of glycine to NO_3 of the glycine-dissolved solution is about 1.5.

5. The method of any of the preceding claims, wherein the catalyst powder has particles in the size range of about 10 nm to 20 nm.

6. A method of activating a catalyst comprising the step of:

   reducing the catalyst in an environment of hydrogen and nitrogen, the reduction occurring at 500ºC for 4 hours, the catalyst including a nickel component, a cerium oxide component, and a gadolinium oxide component such that the catalyst is operable to convert diesel type liquid hydrocarbons to methane rich gas.

7. The method of claim 6 wherein the hydrogen is about 30% wt.

8. The method of either of claims 6 or 7 wherein the nitrogen is about 70% wt.

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9. A method of regenerating a catalyst comprising the steps of:

treating the catalyst after the catalyst has been used for converting diesel type liquid hydrocarbons to methane rich gas with a treatment of water, hydrogen, and nitrogen at atmospheric pressure for a sufficient amount of time to remove coke formation on the catalyst, the catalyst including a nickel component, a cerium oxide component, and a gadolinium oxide component such that the catalyst is operable to convert diesel type liquid hydrocarbons to methane rich gas.

10. The method of claim 9 wherein the hydrogen is about 30% wt.

11. The method of either of claims 9 and 10 wherein the nitrogen is about 45% wt.

12. The method of any of claims 9 to 11 wherein the water is about 45% wt.

13. A method of using a catalyst prepared according to claim 1, further comprising the steps of:

reducing the catalyst in an environment of hydrogen and nitrogen, the reduction occurring at 500ºC for 4 hours, the catalyst including a nickel component, a cerium oxide component, and a gadolinium oxide component such that the catalyst is operable to convert diesel type liquid hydrocarbons to methane rich gas; and

producing a methane rich gas when diesel type liquid hydrocarbons are applied to the catalyst.

14. A catalyst comprising:

a nickel component of 20% wt.,

a cerium oxide component of 70% wt,

and gadolinium oxide component of 10% wt,

said catalyst operable to convert diesel type liquid hydrocarbons to methane rich gas.

15. A catalyst comprising:

a nickel component of 19.5% wt,

a cerium oxide component of 70% wt,

gadolinium oxide component of 10% wt,

a ruthenium component of 0.5% wt,

said catalyst operable to convert diesel type liquid hydrocarbons to methane rich gas.

16. A catalyst for converting diesel type liquid hydrocarbons to methane rich gas, the catalyst comprising:

a nickel component of 20% wt,

a cerium oxide component of 70% wt,

and gadolinium oxide component of 10% wt,

said catalyst being resistant to the formation of coke on the catalyst during use of the catalyst and operable to convert diesel type liquid hydrocarbons to methane rich gas at a rate of 90% or greater.

17. A catalyst for converting diesel type liquid hydrocarbons to methane rich gas, the catalyst comprising:

a nickel component of 19.5% wt,

a cerium oxide component of 70% wt,

gadolinium oxide component of 10% wt,

and a ruthenium component of 0.5% wt,

said catalyst being resistant to the formation of coke on the catalyst during use of the catalyst and operable to convert diesel type liquid hydrocarbons to methane rich gas at a rate of 90% or greater.