CLAIMS

1. A method for synthesizing a zeolite supported catalyst suitable for hydrocracking reactions, the method comprising:

combining a colloidal mixture with a metal oxide support material to form a support precursor material, where the colloidal mixture comprises nano-sized zeolite crystals having an average size of less than 100 nm, and the metal oxide support material comprises a small pore size metal oxide having a pore volume of from 0.4 mL/g to 0.6 mL/g and a large pore size metal oxide having a pore volume of from 0.8 mL/g to 1.2 mL/g;

processing the support precursor material to form a support material; and

impregnating the support material with one or more metals to form the zeolite supported catalyst.

2. The method of claim 1, where the colloidal mixture is formed by autoclaving a mixture containing at least a quaternary ammonium salt, silica, alumina, and water.

3. The method of claim 2, where the quaternary ammonium salt is tetramethylammonium hydroxide.

4. The method of claim 2, where the mixture containing at least quaternary ammonium salt, silica, aluminum, and water has a molar ratio of:

1 mole of alumina;

from 15 moles to 35 moles of the quaternary ammonium salt;

from 20 moles to 80 moles of silica; and

from 250 moles to 1000 moles of water.

5. The method of claim 1, where the small pore size metal oxide is combined with the colloidal mixture comprising nano-sized zeolites before the large pore size metal oxide is combined with the colloidal mixture comprising nano-sized zeolites.

6. The method of claim 1, where the support precursor material further comprises nitric acid.

7. The method of claim 1, where the metal oxide support material is alumina.

8. The method of claim 1, where the metal oxide support material is porous alumina.

9. The method of claim 1, where the step of processing the support precursor material comprises drying the support precursor material to form an extrudable material.

10. The method of claim 1, where the step of processing the support precursor material comprises shaping the support precursor material.

11. The method of claim 10, where the support precursor material is extruded.

12. The method of claim 1, where the step of processing the support precursor material comprises hydrothermally treating the support precursor material.

13. The method of claim 12, where hydrothermally treating the support precursor material comprises exposing the support precursor material to a pressure of from 2 bar to 4 bar and at a temperature of from 450°C to 600°C for 0.5 hours to 3 hours.

14. The method of claim 12, where the hydrothermal treatment produces self-generated steam.

15. The method of claim 1, where the step of impregnating the support material comprises contacting the support material with a solution comprising one or more metal catalyst precursors, where the metal catalyst precursors comprise one or more of Ni, W, Mo, Co.

16. The method of claim 1, where the step of processing the support precursor material comprises shaping the support precursor material followed by hydrothermally treating the support precursor material.