CLAIMS

1. A porous crystalline material having a ZSM-5 framework structure,

the crystalline material having an XO_2:Y_2O_3 ratio of at least about 80, where X is a tetravalent element selected from Si, Ge, Sn, or a combination thereof, and where Y is a trivalent element selected from Al, B, In, Ga, Fe, or a combination thereof;

the crystalline material having a mesopore surface area of at least about 100 m^2/g; and

the crystalline material comprising crystals having a ZSM-5 framework structure and having a rod-like morphology, the crystals having a first crystal dimension corresponding to a crystal length, an average crystal length being about 0.1 μm to about 0.5 μm, and a second crystal dimension with an average dimension value that is about half the average crystal length or less.

2. The crystalline material of claim 1, wherein at least 50 vol % of the crystals having a ZSM-5 framework structure are primary crystallites that form secondary crystal aggregates, the first crystal dimension of the primary crystallites in the secondary crystal aggregates being substantially aligned, the secondary crystal aggregates having an average aggregate length that is at least 5 times the average crystal length, the crystal aggregates having an average aggregate width that is at least 10 times the average dimension value of the second crystal dimension.

3. The crystalline material of claim 1, wherein X is Si, Y is Al, and the crystals having a ZSM-5 framework structure are ZSM-5 crystals.

4. The crystalline material of claim 1, wherein the XO_2:Y_2O_3 ratio is at least about 100.

5. The crystalline material of claim 1, wherein the XO_2:Y_2O_3 ratio is at least about 150.

6. The crystalline material of claim 1, wherein the mesopore surface area is at least about 120 m^2/g.

7. The crystalline material of claim 1, wherein the crystalline material is substantially pure, the substantially pure crystalline material comprising less than 10 wt % of crystalline material that has a framework structure different from a ZSM-5 framework structure.

8. The crystalline material of claim 1, wherein the total surface area of the crystals having a ZSM-5 framework structure is at least about 400 m^2/g.

9. The crystalline material of claim 1, wherein at least a portion of the crystals having a ZSM-5 framework structure contain a structure directing agent within pores thereof.

10. A method for synthesizing a crystalline material having the framework structure of ZSM-5, comprising:

forming a synthesis mixture capable of forming crystals with a zeolite framework structure, the mixture comprising water, a tetravalent oxide (XO_2), an alkali or alkaline earth hydroxide, and a structure directing agent, the mixture having an XO_2:Y_2O_3 ratio of at least about 50, the mixture being suitable for formation of crystals having a ZSM-12 framework structure in the absence of seed crystals having a ZSM-5 framework structure;

adding from about 0.05 wt % to about 5 wt % of seed crystals having a ZSM-5 framework structure into the synthesis mixture; and

recovering substantially pure crystals having a ZSM-5 framework structure from the synthesis mixture, the crystals having a ZSM-5 framework structure having an average size of at least 0.1 μm in at least one dimension,

wherein X is a tetravalent element selected from Si, Ge, Sn, or a combination thereof, and wherein Y is a trivalent element selected from Al, B, In, Ga, Fe, or a combination thereof.

11. The method of claim 10, wherein X is Si and Y is Al.

12. The method of claim 10, wherein the XO_2:Y_2O_3 ratio in the synthesis mixture is at least about 100.

13. The method of claim 10, wherein the recovered crystals having a ZSM-5 framework structure have a mesopore surface area of at least about 100 m^2/g.

14. The method of claim 10, wherein the recovered crystals having a ZSM-5 framework structure have an $XO_2:Y_2O_3$ ratio of at least about 80.

15. The method of claim 14, wherein at least 50 vol % of the recovered crystals are primary crystallites that form secondary crystal aggregates, a first crystal dimension of the primary crystallites in the secondary crystal aggregates being substantially aligned, the first crystal dimension having an average size of at least about 0.1 μm, the secondary crystal aggregates having an average aggregate length that is at least 5 times the average crystal length, the crystal aggregates having an average aggregate width that is at least 10 times the average dimension value of the second crystal dimension.

16. The method of claim 15, wherein the recovered crystals having a ZSM-5 framework structure have an $XO_2:Y_2O_3$ ratio of at least about 100.

17. The method of claim 10, wherein the structure directing agent is a tetraalkyl ammonium salt.

18. The method of claim 10, wherein the structure directing agent is a tetraethyl ammonium salt, a methyltriethyl ammonium salt, or a benzyltriethyl ammonium salt.

19. The method of claim 10, wherein the mixture is suitable for formation of crystals having a ZSM-12 framework structure in the absence of seed crystals.

20. A method for synthesizing a material with the framework structure of ZSM-5, comprising:

forming a synthesis mixture capable of forming crystals with a zeolite framework structure, the mixture comprising water, a tetravalent oxide (XO_2), an alkali or alkaline earth hydroxide, and a structure directing agent, the mixture having an $XO_2:Y_2O_3$ ratio of at least about 100, the structure directing agent being suitable

for formation of crystals having a ZSM-12 framework structure in the absence of seed crystals;

adding from about 0.05 wt % to about 5 wt % of seed crystals having a ZSM-5 framework structure into the synthesis mixture; and

recovering substantially pure crystals having a ZSM-5 framework structure from the synthesis mixture, the crystals having a ZSM-5 framework structure having an average size of at least 0.1 μm in at least one dimension, an $XO_2:Y_2O_3$ ratio of at least about 80, and a mesopore surface area of at least about 100 m^2/g,

wherein X is a tetravalent element selected from Si, Ge, Sn, or a combination thereof, and wherein Y is a trivalent element selected from Al, B, In, Ga, Fe, or a combination thereof.