

WHAT IS CLAIMED IS:

1. A method for preparing finned zeolite crystals, comprising:
preparing a secondary growth solution for epitaxial growth of finned protrusions from zeolite seed crystals, wherein the secondary growth solution comprises one or more framework source precursors, one or more structure-directing agents, and a hydroxide source;
adding the zeolite seed crystals in an amount of about 5 to about 30 weight percent of the secondary growth solution to produce a seeded growth solution;
heating the seeded growth solution to a temperature of about 100°C to about 170°C for about 6 to about 48 hours;
quenching the seeded growth solution to room temperature to produce a final growth solution; and
isolating finned zeolite crystals from the final growth solution.
2. The method of claim 1, wherein the one or more framework source precursors comprise one or both of a silica source and an alumina source.
3. The method of claim 1, wherein the one or more framework source precursors comprise sodium silicate, tetraethylorthosilicate, colloidal silicate, fumed silica, SiO₂, aluminum sulfate, aluminum hydroxide, Al₂O₃, or combinations thereof.
4. The method of claim 1, wherein the structure-directing agents are inorganic, organic, or a combination thereof.
5. The method of claim 1, wherein the structure-directing agents are selected from pyrrolidine, tetrapropylammonium hydroxide, 1,8-diaminooctane, cyclohexylamine and tetrabutylammonium hydroxide.
6. The method of claim 1, wherein the hydroxide source is Na₂O or K₂O.
7. The method of claim 1, wherein the secondary growth solution has a molar composition ratio of a first framework source precursor to a second framework source precursor of about 40:1 to about 120:1.

8. The method of claim 7, wherein the first framework source precursor is SiO_2 and the second framework source precursor is Al_2O_3 .

9. The method of claim 1, wherein the secondary growth solution has a molar composition ratio of a framework source precursor to a structure directing agent of about 2:1 to about 15:1.

10. The method of claim 1, wherein the secondary growth solution has a molar composition ratio of a framework source precursor to the hydroxide source of about 8:1 to about 65:1.

11. The method of claim 1, wherein the finned zeolite crystals are MEL type, MFI type, or FER type.

12. The finned zeolite crystals prepared by the method of claim 1.

13. Finned zeolite crystals, comprising:

a zeolite seed crystal portion, wherein the seed portion comprises a single crystallographic registry, and wherein the seed portion comprises a network of pores; and

a plurality of epitaxially grown fins extending from outer surfaces of the zeolite seed crystal portion, wherein the epitaxially grown fins comprise a single crystallographic registry that is identical to the single crystallographic registry of the zeolite seed crystal portion, and wherein the epitaxially grown fins comprise a network of pores that is continuous with the network of pores of the zeolite seed crystal portion.

14. The finned zeolite crystals of claim 13, wherein the zeolite seed crystal portion has a characteristic size of β , wherein the epitaxially grown fins have a characteristic size of α , and wherein β is greater than α .

15. The finned zeolite crystals of claim 14, wherein α is less than about 50 nm.

16. The finned zeolite crystals of claim 14, wherein adjacent epitaxially grown fins are separate by a pitch, and wherein an average pitch between adjacent epitaxially grown fins is about 20 nm to about 100 nm.

17. The finned zeolite crystals of claim 13, wherein the finned zeolite crystals are MEL type, MFI type, or FER type.