CLAIMS

1. A method of preparing a SSZ-39 zeolite, comprising:

providing a precursor to 3,5-dimethyl-N,N-dimethylpiperidinium cation;

treating the precursor to provide an intermediate that, when subsequently treated to form the 3,5-dimethyl-N,N-dimethylpiperidinium cation, has a content of trans isomer of the 3,5-dimethyl-N,N-dimethylpiperidinium cation to cis isomer of the 3,5-dimethyl-N,N-dimethylpiperidinium cation in a ratio of 1:3 or higher;

contacting under crystallization conditions a mixture of sources of an oxide of silicon and faujasite, one or more alkali metal hydroxide or alkaline earth metal hydroxide, water, and a structure-directing agent comprising the 3,5-dimethyl-N,N-dimethylpiperidinium cation having the content of the trans isomer of the 3,5-dimethyl-N,N-dimethylpiperidinium cation to the cis isomer of the 3,5-dimethyl-N,N-dimethylpiperidinium cation in the ratio of 1:3 or higher; and

calcining the mixture to form a SSZ-39 zeolite.

2. The method of claim 1 wherein the precursor is 3,5-dimethyl pyridine, or N-methyl-3,5-dimethylpiperidine, or 3,5-dimethylpiperidine.

3. The method of claim 1 wherein the treating comprises one or more of chemical reduction, non-catalytic hydrogenation, catalytic hydrogenation in the absence of water, selective crystallization, and distillation.

4. The method of claim 1 wherein the ratio of the trans isomer to the cis isomer in the 3,5-dimethyl-N,N-dimethylpiperidinium cation having an increased content of the trans isomer is at least 40:60.

5. The method of claim 1 wherein the ratio of the cis and trans isomers of the 3,5-dimethyl-N,N-dimethylpiperidinium cation is controlled by selective isolation of 3,5-dimethylpiperidine following hydrogenation of 3,5-dimethylpyridine, and subsequent methylation of the 3,5-dimethylpiperidine to form the 3,5-dimethyl-N,N-dimethylpiperidinium cation, which is subsequently paired with a hydroxide anion.

6. The method of claim 1 wherein the oxide of silicon is one or a combination of two or more of a silicate, a silica hydrogel, silicic acid, fumed silica, colloidal silica, a tetra-alkyl orthosilicate, and a silica hydroxide.

7. The method of claim 1 wherein the precursor is 3,5-dimethylpyridine, and the treating comprises a catalytic reduction to form a mixture of cis- and trans-3,5-dimethylpiperidine.

8. The method of claim 7 wherein the treating further comprises distillation of the mixture to separate the cis-3,5-dimethylpiperidine from the trans-3,5-dimethylpiperidine, and isolation of a fraction substantially enhanced in the cis-3,5-dimethylpiperidine and a fraction substantially enhanced in the trans-3,5-dimethylpiperidine.

9. The method of claim 8 wherein the treating further comprises methylation of the separated cis-3,5-dimethylpiperidine and the trans-3,5-dimethylpiperidine to form the cis isomer of the 3,5-dimethyl-N,N-dimethylpiperidinium cation and the trans isomer of the 3,5-dimethyl-N,N-dimethylpiperidinium cation, paired with a suitable anion.

10. The method of claim 1 wherein the combining under crystallization conditions comprises stirring the mixture at room temperature, and the calcining comprises heating the mixture to an elevated temperature.

11. The method of claim 7 wherein the treating further comprises adding water to a mixture of the cis-3,5-dimethylpiperidine and the trans-3,5-dimethylpiperidine, followed by a step of azeotropic distillation of the mixture to separate the trans-3,5-dimethylpiperidine from the mixture.

12. The method of any one of claims 1 to 3, or 5 to 11, wherein the ratio of the trans isomer to the cis isomer in the 3,5-dimethyl-N,N-dimethylpiperidinium cation ranges from 30:70 to 80:20.

13. A method of making Cu-SSZ-39 zeolite, comprising:

(a) providing a SSZ-39 zeolite made according to any one of claims 1 to 12;

(b) replacing at least a portion of alkali metal cation or alkaline earth metal cation remaining in the SSZ-39 zeolite with a Cu^{+2} cation, to form Cu-SSZ-39.