discloses molecular sieves designated LZ-220 which are more siliceous forms of the known mineral erionite and its synthetic analog, zeolite T. M.L. Occelli *et al.* in *Zeolites*, 1987, 7, 265-271 disclose using templates designated DABCO(I) and DABCO(II) to synthesize ERI/OFF intergrowth molecular sieves.

[006] U.S. Patent No. 7,344,694 reports synthesizing an essentially pure ERI framework type molecular sieve designated UZM-12. UZM-12 is purported to have a Si/Al ratio of greater than 5.5. UZM-12 can be prepared as nanocrystallites having an average particle size of about 15 to about 50 nm and a spheroidal morphology. UZM-12 is synthesized via a charge-density mismatch approach whereby quaternary ammonium hydroxides are employed to solubilize aluminosilicate species, while crystallization inducing agents such as alkali and alkaline earth metals and more highly charged organoammonium cations are often introduced in a separate step.

SUMMARY

[007] The present disclosure is directed to a new family of crystalline molecular sieves with unique properties, referred to herein as "molecular sieve SSZ-98" or simply "SSZ-98." SSZ-98 has the framework type designated "ERI" by the IZA.

[008] In one aspect there is provided a crystalline ERI framework type molecular sieve having a mole ratio of from 15 to 50 of silicon oxide to aluminum oxide. The molecular sieve has either a rod-like crystal morphology or a plate crystal morphology. The SSZ-98 molecular sieve has, in its as-synthesized form, the X-ray diffraction lines of Table 3.

[008a] In another aspect, there is provided a method for preparing an ERI framework type molecular sieve, comprising:

(a) preparing a reaction mixture containing: (1) at least one source of silicon oxide; (2) at least one source of aluminum oxide; (3) one or more sources of one or more elements selected from Groups 1 and 2 of the Periodic Table; (4) hydroxide ions; (5) a N,N'-dimethyl-1,4-diazabicyclo[2.2.2]octane dication; (6) optionally, 18-crown-6; and (7) water; and

(b) subjecting the reaction mixture to crystallization conditions sufficient to form crystals of the molecular sieve, wherein the molecular sieve is prepared from a reaction mixture comprising, in terms of mole ratios, the following:

SiO_2/Al_2O_3	20 to 40
M/SiO_2	0.1 to 0.6
$(Q + A)/SiO_2$	0.1 to 0.5
OH/SiO_2	0.2 to 0.7
H_2O/SiO_2	10 to 25

wherein:

(1) M is selected from the group consisting of elements from Groups 1 and 2 of the Periodic Table;

(2) Q is a N,N′-dimethyl-1,4-diazabicyclo[2.2.2]octane dication, and Q > 0; and

(3) A is 18-crown-6, and A ≥ 0.

[009] In another aspect, there is provided a method for preparing an ERI framework type molecular sieve by contacting under crystallization conditions: (1) at least one source of silicon oxide; (2) at least one source of aluminum oxide; (3) one or more sources of one or more elements selected from Groups 1 and 2 of the Periodic Table; (4) hydroxide ions; (5) a N,N′-dimethyl-1,4-diazabicyclo[2.2.2]octane dication; and (6) optionally, 18-crown-6.

[010] There is also provided a process for preparing a crystalline molecular sieve by: (a) preparing a reaction mixture containing: (1) at least one source of silicon oxide; (2) at least one source of aluminum oxide; (3) one or more sources of one or more elements selected from Groups 1 and 2 of the Periodic Table; (4) hydroxide ions; (5) a N,N′-dimethyl-1,4-diazabicyclo[2.2.2]octane dication; (6) optionally, 18-crown-6; and (7) water; and (b) subjecting the reaction mixture to crystallization conditions sufficient to form crystals of the molecular sieve. The present disclosure includes such a method wherein the crystalline

CLAIMS

1. A method for preparing an ERI framework type molecular sieve, comprising:

(a) preparing a reaction mixture containing: (1) at least one source of silicon oxide; (2) at least one source of aluminum oxide; (3) one or more sources of one or more elements selected from Groups 1 and 2 of the Periodic Table; (4) hydroxide ions; (5) a N,N'-dimethyl-1,4-diazabicyclo[2.2.2]octane dication; (6) optionally, 18-crown-6; and (7) water; and

(b) subjecting the reaction mixture to crystallization conditions sufficient to form crystals of the molecular sieve.

2. The method of claim 1, wherein the molecular sieve is prepared from a reaction mixture comprising, in terms of mole ratios, the following:

SiO_2/Al_2O_3	10 to 50
M/SiO_2	0.01 to 1.0
$(Q + A)/SiO_2$	0.05 to 0.5
OH/SiO_2	0.1 to 1.0
H_2O/SiO_2	10 to 50

wherein:

(1) M is selected from the group consisting of elements from Groups 1 and 2 of the Periodic Table;

(2) Q is a N,N'-dimethyl-1,4-diazabicyclo[2.2.2]octane dication, and $Q > 0$; and

(3) A is 18-crown-6, and $A \geq 0$.

3. The method of claim 2, wherein the molecular sieve is prepared from a reaction mixture comprising, in terms of mole ratios, the following:

SiO_2/Al_2O_3	20 to 40
M/SiO_2	0.1 to 0.6
$(Q + A)/SiO_2$	0.1 to 0.5
OH/SiO_2	0.2 to 0.7
H_2O/SiO_2	10 to 25

4. The method of claim 2, wherein M is potassium.

5. The method of claim 2, wherein M is a combination of potassium and strontium.

6. The method of claim 2, wherein the reaction mixture further comprises seed crystals having a framework type of ERI, KFI, or a combination thereof.

7. The method of claim 6, wherein the seed crystals are present in an amount such that the mole ratio of seed crystals/SiO_2 in the reaction mixture is from 0.001 to 0.1.

8. The method of claim 1, wherein the molecular sieve has less than 2.5% OFF framework type character as determined by X-ray diffraction.

9. The method of claim 1, wherein the molecular sieve has a composition, as-synthesized and in its anhydrous state, in terms of mole ratios, as follows:

SiO_2/Al_2O_3	15 to 50
$(Q + A)/SiO_2$	0.01 to 0.10
M/SiO_2	0.01 to 0.20

wherein:

(1) Q is a N,N'-dimethyl-1,4-diazabicyclo[2.2.2]octane dication, and $Q > 0$;

(2) A is 18-crown-6, and $A \geq 0$; and

(3) M is selected from the group consisting of elements from Groups 1 and 2 of the Periodic Table.

10. The method of claim 1, wherein the molecular sieve has, in its as-synthesized form, an X-ray diffraction pattern substantially as shown in the following Table:

2-Theta	d-spacing (nm)	Relative Intensity
7.78 ± 0.20	1.136	VS
9.74 ± 0.20	0.907	W
11.79 ± 0.20	0.750	W
13.46 ± 0.20	0.657	S
14.10 ± 0.20	0.627	W
15.53 ± 0.20	0.570	M
16.62 ± 0.20	0.533	W
19.51 ± 0.20	0.455	W
20.56 ± 0.20	0.432	VS
21.40 ± 0.20	0.415	M
23.38 ± 0.20	0.380	S
23.76 ± 0.20	0.374	VS
24.88 ± 0.20	0.358	W

CLAIMS

1. A method for preparing an ERI framework type molecular sieve, comprising:

(a) preparing a reaction mixture containing: (1) at least one source of silicon oxide; (2) at least one source of aluminum oxide; (3) one or more sources of one or more elements selected from Groups 1 and 2 of the Periodic Table; (4) hydroxide ions; (5) a N,N'-dimethyl-1,4-diazabicyclo[2.2.2]octane dication; (6) optionally, 18-crown-6; and (7) water; and

(b) subjecting the reaction mixture to crystallization conditions sufficient to form crystals of the molecular sieve, wherein the molecular sieve is prepared from a reaction mixture comprising, in terms of mole ratios, the following:

SiO_2/Al_2O_3	20 to 40
M/SiO_2	0.1 to 0.6
$(Q + A)/SiO_2$	0.1 to 0.5
OH/SiO_2	0.2 to 0.7
H_2O/SiO_2	10 to 25

wherein:

(1) M is selected from the group consisting of elements from Groups 1 and 2 of the Periodic Table;

(2) Q is a N,N'-dimethyl-1,4-diazabicyclo[2.2.2]octane dication, and $Q > 0$; and

(3) A is 18-crown-6, and $A \geq 0$.

2. The method of claim 1, wherein M is potassium.

3. The method of claim 1, wherein M is a combination of potassium and strontium.

4. The method of claim 1, wherein the reaction mixture further comprises seed crystals having a framework type of ERI, KFI, or a combination thereof.

5. The method of claim 4, wherein the seed crystals are present in an amount such that the mole ratio of seed crystals/SiO_2 in the reaction mixture is from 0.001 to 0.1.

6. The method of claim 1, wherein the molecular sieve has less than 2.5% OFF framework type character as determined by X-ray diffraction.

7. The method of claim 1, wherein the molecular sieve has a composition, as-synthesized and in its anhydrous state, in terms of mole ratios, as follows:

SiO_2/Al_2O_3	15 to 50
$(Q + A)/SiO_2$	0.01 to 0.10
M/SiO_2	0.01 to 0.20

wherein:

(1) Q is a N,N'-dimethyl-1,4-diazabicyclo[2.2.2]octane dication, and $Q > 0$;

(2) A is 18-crown-6, and $A \geq 0$; and

(3) M is selected from the group consisting of elements from Groups 1 and 2 of the Periodic Table.

8. The method of claim 1, wherein the molecular sieve has, in its as-synthesized form, an X-ray diffraction pattern substantially as shown in the following Table:

2-Theta	d-spacing (nm)	Relative Intensity
7.78 ± 0.20	1.136	VS
9.74 ± 0.20	0.907	W
11.79 ± 0.20	0.750	W
13.46 ± 0.20	0.657	S
14.10 ± 0.20	0.627	W
15.53 ± 0.20	0.570	M
16.62 ± 0.20	0.533	W
19.51 ± 0.20	0.455	W
20.56 ± 0.20	0.432	VS
21.40 ± 0.20	0.415	M
23.38 ± 0.20	0.380	S
23.76 ± 0.20	0.374	VS
24.88 ± 0.20	0.358	W