CLAIMS:

1. A coherently grown composite of TUN and IMF zeotypes having a three-dimensional framework of at least AlO_2 and SiO_2 tetrahedral units and an empirical composition in the as synthesized and anhydrous basis expressed by an empirical formula of:

$$Na_nM_m^{k+}T_tAl_{1-x}E_xSi_yO_z$$

where "n" is the mole ratio of Na to (Al + E) and has a value from 0.05 to 0.5, M represents at least one metal selected from the group consisting of zinc, Group 1 (IUPAC 1), Group 2 (IUPAC 2), Group 3 (IUPAC 3), and the lanthanide series of the periodic table, and any combination thereof, "m" is the mole ratio of M to (Al + E) and has a value from 0 to 0.5, "k" is the average charge of the metal or metals M, T is the organic structure directing agent or agents derived from reactants R and Q where R is an A,Ω-dihalogen substituted alkane having from 3 to 6 carbon atoms and Q is at least one neutral monoamine having 6 or fewer carbon atoms, "t" is the mole ratio of N from the organic structure directing agent or agents to (Al + E) and has a value of from 0.5 to 1.5, E is an element selected from the group consisting of gallium, iron, boron and combinations thereof, "x" is the mole fraction of E and has a value from 0 to 1.0, "y" is the mole ratio of Si to (Al + E) and varies from greater than 9 to 25 and "z" is the mole ratio of O to (Al + E) and has a value determined by the equation:

$$z = (n + k \bullet m + 3 + 4 \bullet y)/2$$

and is characterized in that it has TUN regions and IMF regions that are coherently aligned so that the $[010]_{TUN}$ zone axis and the $[001]_{IMF}$ zone axis are parallel to each other and there is continuity of crystal planes of type $(002)_{TUN}$ and $(060)_{IMF}$, where the indexing is referred to monoclinic $C_{2/m}$ and orthorhombic C_{mcm} unit cells for TUN and IMF respectively.

2. The coherently grown composite of TUN and IMF zeotypes of claim 1 further characterized by having the x-ray diffraction pattern having at least the d-spacings and intensities set forth in Table A1:

TABLE A1

2θ	d (Å)	I/Io %
7.17-7.21	12.25-12.31	vw-m
7.5-8.1*	11.78-10.91	w-m
8.88	9.95	m
9.17	9.63	w-m

12.47-12.62	7.09-7.00	w-m
17.7	5.01	vw-m
22.8-23.2	3.90-3.83	vs
23.39-23.49	3.80-3.78	m-s
25.01-25.31	3.56-3.52	m
28.74-29.25	3.10-3.05	w-m
45.08-45.29	2.01-2.00	w

*composite peak consisting of multiple overlapping reflections

3. The coherently grown composite of TUN and IMF zeotypes of claim 1 wherein the zeolite is thermally stable up to a temperature of greater than 600°C.

4. The coherently grown composite of TUN and IMF zeotypes of claim 1 composition in the hydrogen form after calcination, ion-exchange and calcination and on an anhydrous basis expressed by an empirical formula of

$$\mathbf{M1_a^{N+}Al_{(1-x)}E_xSi_{y'}O_{z''}}$$

and where M1 is at least one exchangeable cation selected from the group consisting of alkali, alkaline earth metals, rare earth metals, zinc, ammonium ion, hydrogen ion and combinations thereof, "a" is the mole ratio of M1 to (Al + E) and varies from 0.05 to 50, "N" is the weighted average valence of M1 and has a value of +1 to +3, E is an element selected from the group consisting of gallium, iron, boron, and combinations thereof, "x" is the mole fraction of E and varies from 0 to 1.0, y' is the mole ratio of Si to (Al + E) and varies from greater than 9 to virtually pure silica and z" is the mole ratio of O to (Al + E) and has a value determined by the equation:

$$\mathbf{z'' = (a \bullet N + 3 + 4 \bullet y')/2}$$

and is characterized in that it has TUN regions and IMF regions that are coherently aligned so that the $[010]_{TUN}$ zone axis and the $[001]_{IMF}$ zone axis are parallel to each other and there is continuity of crystal planes of type $(002)_{TUN}$ and $(060)_{IMF}$, where the indexing is referred to monoclinic $C_{2/m}$ and orthorhombic C_{mcm} unit cells for TUN and IMF respectively.

5. The coherently grown composite of TUN and IMF zeotypes of claim 4 further characterized by having the x-ray diffraction pattern having at least the d-spacings and intensities set forth in Table B1:

TABLE B1

2θ	d (Å)	I/Io %
7.11-7.16	12.42-12.25	vw-m

7.5-8.1*	11.78-10.91	m-s
8.84	10.00	m-s
9.06-9.08	9.75-9.73	w-m
9.24	9.56	vw-m
12.46-12.53	7.10-7.06	w-m
22.56	3.94	vw-m
22.75-23.2	3.90-3.83	vs
23.40	3.80	m-s
24.12-24.23	3.69-3.67	w-m
24.92-25.37	3.57-3.51	m
28.71-29.27	3.11-3.05	w-m
45.32-45.36	2.00	w

*composite peak consisting of multiple overlapping reflections

6. A process for preparing a coherently grown composite of TUN and IMF zeotypes having a three-dimensional framework of at least AlO_2 and SiO_2 tetrahedral units and an empirical composition in the as synthesized and anhydrous basis expressed by an empirical formula of:

$$Na_nM_m^{k+}T_tAl_{1-x}E_xSi_yO_z$$

where "n" is the mole ratio of Na to (Al + E) and has a value from 0.05 to 0.5, M represents at least one metal selected from the group consisting of zinc, Group 1 (IUPAC 1), Group 2 (IUPAC 2), Group 3 (IUPAC 3) and the lanthanide series of the periodic table, and any combination thereof, "m" is the mole ratio of M to (Al + E) and has a value from 0 to 0.5, "k" is the average charge of the metal or metals M, T is the organic structure directing agent or agents derived from reactants R and Q where R is an A,Ω-dihalogen substituted alkane having from 3 to 6 carbon atoms and Q is at least one neutral monoamine having 6 or fewer carbon atoms, "t" is the mole ratio of N from the organic structure directing agent or agents to (Al + E) and has a value of from 0.5 to 1.5, E is an element selected from the group consisting of gallium, iron, boron and combinations thereof, "x" is the mole fraction of E and has a value from 0 to 1.0, "y" is the mole ratio of Si to (Al + E) and varies from greater than 9 to 25 and "z" is the mole ratio of O to (Al + E) and has a value determined by the equation:

$$z = (n + k \bullet m + 3 + 4 \bullet y)/2$$

and is characterized in that it has TUN regions and IMF regions that are coherently aligned so that the $[010]_{TUN}$ zone axis and the $[001]_{IMF}$ zone axis are parallel to each other and there is

continuity of crystal planes of type $(002)_{TUN}$ and $(060)_{IMF}$, where the indexing is referred to monoclinic $C_{2/m}$ and orthorhombic C_{mcm} unit cells for TUN and IMF respectively, the process comprising forming a reaction mixture containing reactive sources of Na, R, Q, Al, Si, M, seeds of a layered material L wherein L is not the same zeotype as the coherently grown composite, and optionally E, and heating the reaction mixture at a temperature of 140°C to 180°C, for a period of time of 1 day to 28 days, the reaction mixture having a composition expressed in terms of mole ratios of the oxides of:

$$a\text{-}b\ Na_2O : bM_{n/2}O : cRO : dQ : 1\text{-}eAl_2O_3 : eE_2O_3 : fSiO_2 : gH_2O$$

where "a" has a value of 10 to 30, "b" has a value of 0 to 30, "c" has a value of 1 to 10, "d" has a value of 2 to 30, "e" has a value of 0 to 1.0, "f" has a value of 30 to 100, "g" has a value of 100 to 4000 and the reaction mixture further comprising from 1 to 10 wt.-% of seed zeolite L.

7. The process of claim 6 further comprising modifying the coherently grown composite using a technique selected from the group consisting of calcination, ion-exchange, steaming, acid treatment, acid extraction, and combinations thereof.

8. A process comprising contacting at least a first component with a coherently grown composite of TUN and IMF zeotypes at conversion or separation conditions to give a converted or separated product, the catalytic composite selected from the group consisting of

a. a first coherently grown composite of TUN and IMF zeotypes having a three-dimensional framework of at least AlO_2 and SiO_2 tetrahedral units and an empirical composition in the as synthesized and anhydrous basis expressed by an empirical formula of:

$$Na_nM_m^{k+}T_tAl_{1-x}E_xSi_yO_z$$

where "n" is the mole ratio of Na to (Al + E) and has a value from 0.05 to 0.5, M represents at least one metal selected from the group consisting of zinc, Group 1 (IUPAC 1), Group 2 (IUPAC 2), Group 3 (IUPAC 3) and the lanthanide series of the periodic table, and any combination thereof, "m" is the mole ratio of M to (Al + E) and has a value from 0 to 0.5, "k" is the average charge of the metal or metals M, T is the organic structure directing agent or agents derived from reactants R and Q where R is an A,Ω-

dihalogen substituted alkane having from 3 to 6 carbon atoms and Q is at least one neutral monoamine having 6 or fewer carbon atoms, "t" is the mole ratio of N from the organic structure directing agent or agents to (Al + E) and has a value of from 0.5 to 1.5, E is an element selected from the group consisting of gallium, iron, boron and combinations thereof, "x" is the mole fraction of E and has a value from 0 to 1.0, "y" is the mole ratio of Si to (Al + E) and varies from greater than 9 to 25 and "z" is the mole ratio of O to (Al + E) and has a value determined by the equation:

$$z = (n + k \bullet m + 3 + 4 \bullet y)/2$$

and is characterized in that it has TUN regions and IMF regions that are coherently aligned so that the $[010]_{TUN}$ zone axis and the $[001]_{IMF}$ zone axis are parallel to each other and there is continuity of crystal planes of type $(002)_{TUN}$ and $(060)_{IMF}$, where the indexing is referred to monoclinic $C_{2/m}$ and orthorhombic C_{mcm} unit cells for TUN and IMF respectively;

b. a second coherently grown composite of TUN and IMF zeotypes having a three-dimensional framework of at least AlO_2 and SiO_2 tetrahedral units and an empirical composition in the acid treated form and on an anhydrous basis expressed by an empirical formula of

$$\mathbf{M1_a^{N+}Al_{(1-x)}E_xSi_{y'}O_{z''}}$$

and where M1 is at least one exchangeable cation selected from the group consisting of alkali, alkaline earth metals, rare earth metals, zinc, ammonium ion, hydrogen ion and combinations thereof, "a" is the mole ratio of M1 to (Al + E) and varies from 0.05 to 50, "N" is the weighted average valence of M1 and has a value of +1 to +3, E is an element selected from the group consisting of gallium, iron, boron, and combinations thereof, "x" is the mole fraction of E and varies from 0 to 1.0, y' is the mole ratio of Si to (Al + E) and varies from greater than 9 to virtually pure silica and z" is the mole ratio of O to (Al + E) and has a value determined by the equation:

$$\mathbf{z'' = (a \bullet N + 3 + 4 \bullet y')/2}$$

and is characterized in that it has TUN regions and IMF regions that are coherently aligned so that the $[010]_{TUN}$ zone axis and the $[001]_{IMF}$ zone axis are parallel to each

other and there is continuity of crystal planes of type $(002)_{TUN}$ and $(060)_{IMF}$, where the indexing is referred to monoclinic $C_{2/m}$ and orthorhombic C_{mcm} unit cells for TUN and IMF respectively;

and c. combinations thereof.

9. The process of claim 8 wherein the process is selected from the group consisting of cracking, hydrocracking, alkylation of aromatics or isoparaffins, isomerization of paraffin, olefins, or poly-alkylbenzene such as xylene, trans-alkylation of poly-alkybenzene with benzene or mono-alkybenzene, disproportionation of mono-alkybenzene, polymerization, reforming, hydrogenation, dehydrogenation, transalkylation, dealkylation, hydration, dehydration, hydrotreating, hydrodenitrogenation, hydrodesulfurization, methanation, syngas shift process and combinations thereof.

10. The process of claim 8 wherein the process is a separation process comprising contacting at least two components with a material to generate at least one separated component.

CLAIMS:

1. A coherently grown composite of TUN and IMF zeotypes having a three-dimensional framework of at least AlO_2 and SiO_2 tetrahedral units and an empirical composition in the as synthesized and anhydrous basis expressed by an empirical formula of:

$$Na_nM_m^{k+}T_tAl_{1-x}E_xSi_yO_z$$

where "n" is the mole ratio of Na to (Al + E) and has a value from 0.05 to 0.5, M represents at least one metal selected from the group consisting of zinc, Group 1 (IUPAC 1), Group 2 (IUPAC 2), Group 3 (IUPAC 3), and the lanthanide series of the periodic table, and any combination thereof, "m" is the mole ratio of M to (Al + E) and has a value from 0 to 0.5, "k" is the average charge of the metal or metals M, T is the organic structure directing agent or agents derived from reactants R and Q where R is an A,Ω-dihalogen substituted alkane having from 3 to 6 carbon atoms and Q is at least one neutral monoamine having 6 or fewer carbon atoms, "t" is the mole ratio of N from the organic structure directing agent or agents to (Al + E) and has a value of from 0.5 to 1.5, E is an element selected from the group consisting of gallium, iron, boron and combinations thereof, "x" is the mole fraction of E and has a value from 0 to 1.0, "y" is the mole ratio of Si to (Al + E) and varies from greater than 9 to 25 and "z" is the mole ratio of O to (Al + E) and has a value determined by the equation:

$$z = (n + k \bullet m + 3 + 4 \bullet y)/2$$

and is characterized in that it has TUN regions and IMF regions that are coherently aligned so that the $[010]_{TUN}$ zone axis and the $[001]_{IMF}$ zone axis are parallel to each other and there is continuity of crystal planes of type $(002)_{TUN}$ and $(060)_{IMF}$, where the indexing is referred to monoclinic $C_{2/m}$ and orthorhombic C_{mcm} unit cells for TUN and IMF respectively.

2. The coherently grown composite of TUN and IMF zeotypes of claim 1 further characterized by having the x-ray diffraction pattern having at least the d-spacings and intensities set forth in Table A1:

TABLE A1

2θ	d (Å)	I/Io %
7.17-7.21	12.25-12.31	vw-m
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8.88	9.95	m
9.17	9.63	w-m
12.47-12.62	7.09-7.00	w-m
17.7	5.01	vw-m

22.8-23.2	3.90-3.83	vs
23.39-23.49	3.80-3.78	m-s
25.01-25.31	3.56-3.52	m
28.74-29.25	3.10-3.05	w-m
45.08-45.29	2.01-2.00	w

*composite peak consisting of multiple overlapping reflections

3. The coherently grown composite of TUN and IMF zeotypes of claim 1 wherein the zeolite is thermally stable up to a temperature of greater than 600ºC.

4. The coherently grown composite of TUN and IMF zeotypes of claim 1 composition in the hydrogen form after calcination, ion-exchange and calcination and on an anhydrous basis expressed by an empirical formula of

$$\mathbf{M1_a^{N+}Al_{(1-x)}E_xSi_y,O_z"}$$

and where M1 is at least one exchangeable cation selected from the group consisting of alkali, alkaline earth metals, rare earth metals, zinc, ammonium ion, hydrogen ion and combinations thereof, "a" is the mole ratio of M1 to (Al + E) and varies from 0.05 to 50, "N" is the weighted average valence of M1 and has a value of +1 to +3, E is an element selected from the group consisting of gallium, iron, boron, and combinations thereof, "x" is the mole fraction of E and varies from 0 to 1.0, y' is the mole ratio of Si to (Al + E) and varies from greater than 9 to virtually pure silica and z" is the mole ratio of O to (Al + E) and has a value determined by the equation:

$$\mathbf{z" = (a \bullet N + 3 + 4 \bullet y')/2}$$

and is characterized in that it has TUN regions and IMF regions that are coherently aligned so that the $[010]_{TUN}$ zone axis and the $[001]_{IMF}$ zone axis are parallel to each other and there is continuity of crystal planes of type $(002)_{TUN}$ and $(060)_{IMF}$, where the indexing is referred to monoclinic $C_{2/m}$ and orthorhombic C_{mcm} unit cells for TUN and IMF respectively.

5. The coherently grown composite of TUN and IMF zeotypes of claim 4 further characterized by having the x-ray diffraction pattern having at least the d-spacings and intensities set forth in Table B1:

TABLE B1

2θ	d (Å)	I/Io %
7.11-7.16	12.42-12.25	vw-m
7.5-8.1*	11.78-10.91	m-s
8.84	10.00	m-s
9.06-9.08	9.75-9.73	w-m

9.24	9.56	vw-m
12.46-12.53	7.10-7.06	w-m
22.56	3.94	vw-m
22.75-23.2	3.90-3.83	vs
23.40	3.80	m-s
24.12-24.23	3.69-3.67	w-m
24.92-25.37	3.57-3.51	m
28.71-29.27	3.11-3.05	w-m
45.32-45.36	2.00	w

*composite peak consisting of multiple overlapping reflections

6. A process for preparing a coherently grown composite of TUN and IMF zeotypes having a three-dimensional framework of at least AlO_2 and SiO_2 tetrahedral units and an empirical composition in the as synthesized and anhydrous basis expressed by an empirical formula of:

$$Na_nM_m^{k+}T_tAl_{1-x}E_xSi_yO_z$$

where "n" is the mole ratio of Na to (Al + E) and has a value from 0.05 to 0.5, M represents at least one metal selected from the group consisting of zinc, Group 1 (IUPAC 1), Group 2 (IUPAC 2), Group 3 (IUPAC 3) and the lanthanide series of the periodic table, and any combination thereof, "m" is the mole ratio of M to (Al + E) and has a value from 0 to 0.5, "k" is the average charge of the metal or metals M, T is the organic structure directing agent or agents derived from reactants R and Q where R is an A,Ω-dihalogen substituted alkane having from 3 to 6 carbon atoms and Q is at least one neutral monoamine having 6 or fewer carbon atoms, "t" is the mole ratio of N from the organic structure directing agent or agents to (Al + E) and has a value of from 0.5 to 1.5, E is an element selected from the group consisting of gallium, iron, boron and combinations thereof, "x" is the mole fraction of E and has a value from 0 to 1.0, "y" is the mole ratio of Si to (Al + E) and varies from greater than 9 to 25 and "z" is the mole ratio of O to (Al + E) and has a value determined by the equation:

$$z = (n + k \bullet m + 3 + 4 \bullet y)/2$$

and is characterized in that it has TUN regions and IMF regions that are coherently aligned so that the $[010]_{TUN}$ zone axis and the $[001]_{IMF}$ zone axis are parallel to each other and there is continuity of crystal planes of type $(002)_{TUN}$ and $(060)_{IMF}$, where the indexing is referred to monoclinic $C_{2/m}$ and orthorhombic C_{mcm} unit cells for TUN and IMF respectively, the process comprising forming a reaction mixture containing reactive sources of Na, R, Q, Al, Si, M, seeds of a layered material L wherein L is not the same zeotype as the coherently grown composite,

and optionally E, and heating the reaction mixture at a temperature of 140°C to 180°C, for a period of time of 1 day to 28 days, the reaction mixture having a composition expressed in terms of mole ratios of the oxides of:

$$a\text{-}b\ Na_2O : bM_{n/2}O : cRO : dQ : 1\text{-}eAl_2O_3 : eE_2O_3 : fSiO_2 : gH_2O$$

where "a" has a value of 10 to 30, "b" has a value of 0 to 30, "c" has a value of 1 to 10, "d" has a value of 2 to 30, "e" has a value of 0 to 1.0, "f" has a value of 30 to 100, "g" has a value of 100 to 4000 and the reaction mixture further comprising from 1 to 10 wt.-% of seed zeolite L.

7. The process of claim 6 further comprising modifying the coherently grown composite using a technique selected from the group consisting of calcination, ion-exchange, steaming, acid treatment, acid extraction, and combinations thereof.

8. A process comprising contacting at least a first component with a coherently grown composite of TUN and IMF zeotypes at conversion or separation conditions to give a converted or separated product, the catalytic composite selected from the group consisting of

a. a first coherently grown composite of TUN and IMF zeotypes having a three-dimensional framework of at least AlO_2 and SiO_2 tetrahedral units and an empirical composition in the as synthesized and anhydrous basis expressed by an empirical formula of:

$$Na_nM_m^{k+}T_tAl_{1-x}E_xSi_yO_z$$

where "n" is the mole ratio of Na to (Al + E) and has a value from 0.05 to 0.5, M represents at least one metal selected from the group consisting of zinc, Group 1 (IUPAC 1), Group 2 (IUPAC 2), Group 3 (IUPAC 3) and the lanthanide series of the periodic table, and any combination thereof, "m" is the mole ratio of M to (Al + E) and has a value from 0 to 0.5, "k" is the average charge of the metal or metals M, T is the organic structure directing agent or agents derived from reactants R and Q where R is an A,Ω-dihalogen substituted alkane having from 3 to 6 carbon atoms and Q is at least one neutral monoamine having 6 or fewer carbon atoms, "t" is the mole ratio of N from the organic structure directing agent or agents to (Al + E) and has a value of from 0.5 to 1.5, E is an element selected from the group consisting of gallium, iron, boron and combinations thereof, "x" is the mole fraction of E and has a value from 0 to 1.0, "y" is

the mole ratio of Si to (Al + E) and varies from greater than 9 to 25 and "z" is the mole ratio of O to (Al + E) and has a value determined by the equation:

$$z = (n + k \bullet m + 3 + 4 \bullet y)/2$$

and is characterized in that it has TUN regions and IMF regions that are coherently aligned so that the $[010]_{TUN}$ zone axis and the $[001]_{IMF}$ zone axis are parallel to each other and there is continuity of crystal planes of type $(002)_{TUN}$ and $(060)_{IMF}$, where the indexing is referred to monoclinic $C_{2/m}$ and orthorhombic C_{mcm} unit cells for TUN and IMF respectively;

b. a second coherently grown composite of TUN and IMF zeotypes having a three-dimensional framework of at least AlO_2 and SiO_2 tetrahedral units and an empirical composition in the acid treated form and on an anhydrous basis expressed by an empirical formula of

$$\mathbf{M1_a^{N+}Al_{(1-x)}E_xSi_{y'}O_{z"}}$$

and where M1 is at least one exchangeable cation selected from the group consisting of alkali, alkaline earth metals, rare earth metals, zinc, ammonium ion, hydrogen ion and combinations thereof, "a" is the mole ratio of M1 to (Al + E) and varies from 0.05 to 50, "N" is the weighted average valence of M1 and has a value of +1 to +3, E is an element selected from the group consisting of gallium, iron, boron, and combinations thereof, "x" is the mole fraction of E and varies from 0 to 1.0, y' is the mole ratio of Si to (Al + E) and varies from greater than 9 to virtually pure silica and z" is the mole ratio of O to (Al + E) and has a value determined by the equation:

$$\mathbf{z" = (a \bullet N + 3 + 4 \bullet y')/2}$$

and is characterized in that it has TUN regions and IMF regions that are coherently aligned so that the $[010]_{TUN}$ zone axis and the $[001]_{IMF}$ zone axis are parallel to each other and there is continuity of crystal planes of type $(002)_{TUN}$ and $(060)_{IMF}$, where the indexing is referred to monoclinic $C_{2/m}$ and orthorhombic C_{mcm} unit cells for TUN and IMF respectively;

and c. combinations thereof.

9. The process of claim 8 wherein the process is selected from the group consisting of cracking, hydrocracking, alkylation of isoparaffins, isomerization of paraffin, or olefins,

polymerization, reforming, hydrogenation, dehydrogenation, transalkylation, dealkylation, hydration, dehydration, hydrotreating, hydrodenitrogenation, hydrodesulfurization, methanation, syngas shift process and combinations thereof.

10. The process of claim 8 wherein the process is a separation process comprising contacting at least two components with a material to generate at least one separated component.