WHAT IS CLAIMED IS:

1. A method of sequestering carbon dioxide produced by a source, comprising:

   (a) reacting a first cation-based halide, sulfate or nitrate salt or hydrate thereof with water in a first admixture under conditions suitable to form a first product mixture comprising a first step (a) product comprising a first cation-based hydroxide salt, a first cation-based oxide salt and/or a first cation-based hydroxychloride salt and a second step (a) product comprising HCl, H_2SO_4 or HNO_3;

   (b) admixing some or all of the first step (a) product with a second cation-based halide, sulfate or nitrate salt or hydrate thereof and carbon dioxide produced by the source in a second admixture under conditions suitable to form a second product mixture comprising a first step (b) product comprising a first-cation-based halide, sulfate and/or nitrate salt or hydrate thereof, a second step (b) product comprising a second cation-based carbonate salt, and a third step (b) product comprising water; and

   (c) separating some or all of the second cation-based carbonate salt from the second product mixture,

   whereby the carbon dioxide is sequestered into a mineral product form.

2. The method of claim 1, wherein the first cation-based halide, sulfate or nitrate salt or hydrate thereof of step (a) is a first cation-based chloride salt or hydrate thereof, and the second step (a) product is HCl.

3. The method according to any one of claim 1-2, wherein the first cation-based halide, sulfate, or nitrate salt or hydrate thereof of step (b) is a first cation-based chloride salt or hydrate thereof.

4. The method of claim 2, wherein the first cation-based chloride salt or hydrate thereof of step (a) is $MgCl_2$.

5. The method of claim 4, wherein the first cation-based chloride salt or hydrate thereof of step (a) is a hydrated form of $MgCl_2$.

6. The method of claim 5, wherein the first cation-based chloride salt or hydrate thereof of step (a) is $MgCl_2 \cdot 6H_2O$.

7. The method according to any one of claims 1-6, wherein the first cation-based hydroxide salt of step (a) is $Mg(OH)_2$.

8. The method according to any one of claims 2-6, wherein the first cation-based hydroxychloride salt of step (a) is Mg(OH)Cl.

9. The method of claim 8, wherein the first step (a) product comprises predominantly Mg(OH)Cl.

10. The method of claim 8, wherein the first step (a) product comprises greater than 90% by weight Mg(OH)Cl.

11. The method of claim 8, wherein the first step (a) product is Mg(OH)Cl.

12. The method according to any one of claims 1-6, wherein the first cation-based oxide salt of step (a) is MgO.

13. The method according to any one of claims 1-12, wherein the second cation-based halide, sulfate or nitrate salt or hydrate thereof of step (b) is a second cation-based chloride salt or hydrate thereof.

14. The method of claim 13, wherein the second cation-based chloride salt or hydrate thereof is $CaCl_2$.

15. The method according to any one of claims 3-12, wherein the first cation-based chloride salt of step (b) is $MgCl_2$.

16. The method of claim 15, wherein the first cation-based chloride salt of step (b) is a hydrated form of $MgCl_2$.

17. The method of claim 15, wherein the first cation-based chloride salt of step (b) is $MgCl_2 \cdot 6H_2O$.

18. The method according to any one of claims 1-17, where some or all of the water in step (a) is present in the form of steam or supercritical water.

19. The method according to any one of claims 1-18, where some or all of the water of step (a) is obtained from the water of step (b).

20. The method according to any one of claims 1-19, wherein step (b) further comprises admixing sodium hydroxide salt in the second admixture.

21. A method of any one of claims 1-20, further comprising:

(d) admixing a Group 2 silicate mineral with HCl under conditions suitable to form a third product mixture comprising a Group 2 chloride salt, water, and silicon dioxide.

22. The method of claim 21, where some or all of the HCl in step (d) is obtained from step (a).

23. The method of claim 21, wherein the HCl of step (d) further comprises agitating the Group 2 silicate mineral with HCl.

24. The method according to any one of claims 21-23, wherein some or all of the heat generated in step (d) is recovered.

25. The method according to any one of claims 21-24, where some or all of the second cation-based chloride salt of step (b) is the Group 2 chloride salt of step (d).

26. The method according to any one of claims 21-25, further comprising a separation step, wherein the silicon dioxide is removed from the Group 2 chloride salt formed in step (d).

27. The method according to any one of claims 21-26, where some or all of the water of step (a) is obtained from the water of step (d).

28. The method according to any one of claims 21-26, wherein the Group 2 silicate mineral of step (d) comprises a Group 2 inosilicate.

29. The method according to any one of claims 21-26, wherein the Group 2 silicate mineral of step (d) comprises $CaSiO_3$.

30. The method according to any one of claims 21-26, wherein the Group 2 silicate mineral of step (d) comprises $MgSiO_3$.

31. The method according to any one of claims 21-26, wherein the Group 2 silicate mineral of step (d) comprises olivine ($Mg_2[SiO_4]$).

32. The method according to any one of claims 21-26, wherein the Group 2 silicate mineral of step (d) comprises serpentine ($Mg_6[OH]_8[Si_4O_{10}]$).

33. The method according to any one of claims 21-26, wherein the Group 2 silicate mineral of step (d) comprises sepiolite ($Mg_4[(OH)_2Si_6O_{15}]\cdot 6H_2O$), enstatite ($Mg_2[Si_2O_6]$), diopside ($CaMg[Si_2O_6]$), and/or tremolite $Ca_2Mg_5\{[OH]Si_4O_{11}\}_2$.

34. The method according to any one of claims 21-26, wherein the Group 2 silicate further comprises iron and or manganese silicates.

35. The method of claim 34, wherein the iron silicate is fayalite ($Fe_2[SiO_4]$).

36. The method according to any one of claims 3-35, wherein some or all of the first cation-based chloride salt formed in step (b) is the first cation-based chloride salt used in step (a).

37. The method according to any one of claims 1-36, wherein the carbon dioxide is in the form of flue gas, wherein the flue gas further comprises N_2 and H_2O.

38. The method according to any one of claims 1-37, wherein suitable reacting conditions of step (a) comprise a temperature from about 200 °C to about 500 °C.

39. The method of claim 38, wherein the temperature is from about 230 °C to about 260 °C.

40. The method of claim 38, wherein the temperature is about 250 °C.

41. The method of claim 38, wherein the temperature is from about 200 °C to about 250 °C.

42. The method of claim 38, wherein the temperature is about 240 °C.

43. The method according to any one of claims 1-37, wherein suitable reacting conditions of step (a) comprise a temperature from about 50 °C to about 200 °C.

44. The method of claim 43, wherein the temperature is from about 90 °C to about 260 °C.

45. The method of claim 44, wherein the temperature is from about 90 °C to about 230 °C.

46. The method of claim 45, wherein the temperature is about 130 °C.

47. The method according to any one of claims 1-37, wherein suitable reacting conditions of step (a) comprise a temperature from about 400 °C to about 550 °C.

48. The method of claim 47, wherein the temperature is from about 450 °C to about 500 °C.

49. The method according to any one of claims 1-37, wherein suitable reacting conditions of step (b) comprise a temperature from about 20 °C to about 100 °C.

50. The method of claim 49, wherein the temperature is from about 25 °C to about 95 °C.

51. The method according to any one of claims 21-37, wherein suitable reacting conditions of step (d) comprise a temperature from about 50 °C to about 200 °C.

52. The method of claim 51, wherein the temperature is from about 90 °C to about 150 °C.

53. A method of sequestering carbon dioxide produced by a source, comprising:

(a) admixing a magnesium chloride salt and water in a first admixture under conditions suitable to form (i) magnesium hydroxide, magnesium oxide and/or Mg(OH)Cl and (ii) hydrogen chloride;

(b) admixing (i) magnesium hydroxide, magnesium oxide and/or Mg(OH)Cl, (ii) $CaCl_2$ and (iii) carbon dioxide produced by the source in a second admixture under conditions suitable to form (iv) calcium carbonate, (v) a magnesium chloride salt, and (vi) water; and

(c) separating the calcium carbonate from the second admixture,

whereby the carbon dioxide is sequestered into a mineral product form.

54. The method of claim 53, wherein some or all of the hydrogen chloride of step (a) is admixed with water to form hydrochloric acid.

55. The method of claim 53, where some or all of the magnesium hydroxide, magnesium oxide and/or Mg(OH)Cl of step (b)(i) is obtained from step (a)(i).

56. The method of claim 53, where some of all the water in step (a) is present in the form of a hydrate of the magnesium chloride salt.

57. The method of claim 53, wherein step (a) occurs in one, two or three reactors.

58. The method of claim 53, wherein step (a) occurs in one reactor.

59. The method of claim 53, wherein the magnesium hydroxide, magnesium oxide and/or Mg(OH)Cl of step (a)(i) is greater than 90% by weight Mg(OH)Cl.

60. The method of claim 53, wherein the magnesium chloride salt is greater than 90% by weight $MgCl_2 \cdot 6(H_2O)$.

61. A method of any one of claims 53-60, further comprising:

(d) admixing a Group 2 silicate mineral with hydrogen chloride under conditions suitable to form a Group 2 chloride salt, water, and silicon dioxide.

62. The method of claim 61, where some or all of the hydrogen chloride in step (d) is obtained from step (a).

63. The method of claim 61, wherein step (d) further comprises agitating the Group 2 silicate mineral with the hydrochloric acid.

64. The method of claim 61, where some or all of the magnesium chloride salt in step (a) is obtained from step (d).

65. The method of claim 61, further comprising a separation step, wherein the silicon dioxide is removed from the Group 2 chloride salt formed in step (d).

66. The method of claim 61, where some or all of the water of step (a) is obtained from the water of step (d).

67. The method of claim 61, wherein the Group 2 silicate mineral of step (d) comprises a Group 2 inosilicate.

68. The method of claim 61 wherein the Group 2 silicate mineral of step (d) comprises $CaSiO_3$.

69. The method of claim 61, wherein the Group 2 silicate mineral of step (d) comprises $MgSiO_3$.

70. The method of claim 61, wherein the Group 2 silicate mineral of step (d) comprises olivine.

71. The method of claim 61, wherein the Group 2 silicate mineral of step (d) comprises serpentine.

72. The method of claim 61, wherein the Group 2 silicate mineral of step (d) comprises sepiolite, enstatite, diopside, and/or tremolite.

73. The method of claim 61 wherein the Group 2 silicate further comprises mineralized iron and or manganese.

74. The method according to any one of claims 53-66, wherein step (b) further comprises admixing $CaCl_2$ and water to the second admixture.

CLAIMS

1. A method of sequestering carbon dioxide produced by a source, comprising:

   (a) reacting a first cation-based halide, sulfate or nitrate salt or hydrate thereof with water in a first admixture under conditions suitable to form a first product mixture comprising a first step (a) product comprising a first cation-based hydroxide salt, a first cation-based oxide salt and/or a first cation-based hydroxychloride salt and a second step (a) product comprising HCl, H_2SO_4 or HNO_3;

   (b) admixingsome or all of the first step (a) product with a second cation-based halide, sulfate or nitrate salt or hydrate thereof and carbon dioxide produced by the source in a second admixture under conditions suitable to form a second product mixture comprising a first step (b) product comprising a first-cation-based halide, sulfate and/or nitrate salt or hydrate thereof, a second step (b) product comprising a second cation-based carbonate salt, and a third step (b) product comprising water; and

   (c) separating some or all of the second cation-based carbonate salt from the second product mixture,

   wherein the carbon dioxide is sequestered into a mineral product form.

2. The method of claim 1, wherein the first cation-based halide, sulfate or nitrate salt or hydrate thereof of step (a) is a first cation-based chloride salt or hydrate thereof, and the second step (a) product is HCl.

3. The method according to claim 1 or claim 2, wherein the first cation-based halide, sulfate, or nitrate salt or hydrate thereof of step (b) is a first cation-based chloride salt or hydrate thereof.

4. The method of any one of claims 1 to 3, wherein the first cation-based chloride salt or hydrate thereof of step (a) is $MgCl_2$.

5. The method of any one of claims 1 to 4, wherein the first cation-based chloride salt or hydrate thereof of step (a) is a hydrated form of $MgCl_2$.

6. The method of any one of claims 1 to 5, wherein the first cation-based chloride salt or hydrate thereof of step (a) is $MgCl_2 \cdot 6H_2O$.

7. The method according to any one of claims 1-6, wherein the first cation-based hydroxide salt of step (a) is $Mg(OH)_2$.

8. The method according to any one of claims 2-6, wherein the first cation-based hydroxychloride salt of step (a) is Mg(OH)Cl.

9. The method of claim 8, wherein the first step (a) product comprises predominantly Mg(OH)Cl.

10. The method of claim 8 or claim 9, wherein the first step (a) product comprises greater than 90% by weight Mg(OH)Cl.

11. The method of any one of claims 8 to 9, wherein the first step (a) product is Mg(OH)Cl.

12. The method according to any one of claims 1-6, wherein the first cation-based oxide salt of step (a) is MgO.

13. The method according to any one of claims 1-12, wherein the second cation-based halide, sulfate or nitrate salt or hydrate thereof of step (b) is a second cation-based chloride salt or hydrate thereof.

14. The method of claim 13, wherein the second cation-based chloride salt or hydrate thereof is $CaCl_2$.

15. The method according to any one of claims 3-12, wherein the first cation-based chloride salt of step (b) is $MgCl_2$.

16. The method of claim 15, wherein the first cation-based chloride salt of step (b) is a hydrated form of $MgCl_2$.

17. The method of claim 15 or claim 16, wherein the first cation-based chloride salt of step (b) is $MgCl_2 \cdot 6H_2O$.

18. The method according to any one of claims 1-17, where some or all of the water in step (a) is present in the form of steam or supercritical water.

19. The method according to any one of claims 1-18, where some or all of the water of step (a) is obtained from the water of step (b).

20. The method according to any one of claims 1-19, wherein step (b) further comprises admixing sodium hydroxide salt in the second admixture.

21. A method of any one of claims 1-20, further comprising:

(d) admixing a Group 2 silicate mineral with HCl under conditions suitable to form a third product mixture comprising a Group 2 chloride salt, water, and silicon dioxide.

22. The method of claim 21, where some or all of the HCl in step (d) is obtained from step (a).

23. The method of claim 21, wherein the HCl of step (d) further comprises agitating the Group 2 silicate mineral with HCl.

24. The method according to any one of claims 21-23, wherein some or all of the heat generated in step (d) is recovered.

25. The method according to any one of claims 21-24, where some or all of the second cation-based chloride saltof step (b) is the Group 2 chloride salt of step (d).

26. The method according to any one of claims 21-25, further comprising a separation step, wherein the silicon dioxide is removed from the Group 2 chloride salt formed in step (d).

27. The method according to any one of claims 21-26, where some or all of the water of step (a) is obtained from the water of step (d).

28. The method according to any one of claims 21-26, wherein the Group 2 silicate mineral of step (d) comprises a Group 2 inosilicate.

29. The method according to any one of claims 21-26, wherein the Group 2 silicate mineral of step (d) is selected from the group consisting of $CaSiO_3$, $MgSiO_3$, olivine ($Mg_2[SiO_4]$), serpentine ($Mg_6[OH]_8[Si_4O_{10}]$), sepiolite ($Mg_4[(OH)_2Si_6O_{15}]\cdot 6H_2O$), enstatite ($Mg_2[Si_2O_6]$), diopside ($CaMg[Si_2O_6]$), tremolite $Ca_2Mg_5\{[OH]Si_4O_{11}\}_2$, and combinations thereof.

30. The method according to any one of claims 21-26, wherein the Group 2 silicate further comprises iron and/or manganese silicates.

31. The method of claim 30, wherein the iron silicate is fayalite ($Fe_2[SiO_4]$).

32. The method according to any one of claims 3-31, wherein some or all of the first cation-based chloride salt formed in step (b) is the first cation-based chloride salt used in step (a).

33. The method according to any one of claims 1-32, wherein the carbon dioxide is in the form of flue gas, wherein the flue gas further comprises N_2 and H_2O.

34. A method of sequestering carbon dioxide produced by a source, comprising:

(a) admixing a magnesium chloride salt and water in a first admixture under conditions suitable to form (i) magnesium hydroxide, magnesium oxide and/or Mg(OH)Cl and (ii) hydrogen chloride;

(b) admixing(i) magnesium hydroxide, magnesium oxide and/or Mg(OH)Cl, (ii) $CaCl_2$ and (iii) carbon dioxide produced by the source in a second admixture under conditions suitable to form (iv) calcium carbonate, (v) a magnesium chloride salt, and (vi) water; and

(c) separating thecalcium carbonate from the second admixture,

wherein the carbon dioxide is sequestered into a mineral product form, and wherein some or all of the magnesium hydroxide, magnesium oxide and/or Mg(OH)Cl of step (b)(i) is obtained from step (a)(i).

35. The method of claim 34, wherein some or all of the hydrogen chloride of step (a) is admixed with water to form hydrochloric acid.

36. The method of claim 34, where some of all the water in step (a) is present in the form of a hydrate of the magnesium chloride salt.

37. The method of any one of claims 34 to 36, wherein step (a) occurs in one, two or three reactors.

38. The method of any one of claims 34 to 37, wherein step (a) occurs in one reactor.

39. The method of claim 34, wherein the magnesium hydroxide, magnesium oxide and/or Mg(OH)Cl of step (a)(i) is greater than 90% by weight Mg(OH)Cl.

40. The method of claim 34, wherein the magnesium chloride salt is greater than 90% by weight $MgCl_2 \cdot 6(H_2O)$.

41. A method of any one of claims 34 to 40, further comprising:

(d) admixing a Group 2 silicate mineral with hydrogen chloride under conditions suitable to form a Group 2 chloride salt, water, and silicon dioxide.

42. The method of claim 41, where some or all of the hydrogen chloride in step (d) is obtained from step (a).

43. The method of claim 41, wherein step (d) further comprises agitating the Group 2 silicate mineral with the hydrochloric acid.

44. The method of claim 41, where some or all of the magnesium chloride salt in step (a) is obtained from step (d).

45. The method of claim 41, further comprising a separation step, wherein the silicon dioxide is removed from the Group 2 chloride salt formed in step (d).

46. The method of claim 41, where some or all of the water of step (a) is obtained from the water of step (d).

47. The method of any one of claims 41 to 46, wherein the Group 2 silicate mineral of step (d) comprises a Group 2 inosilicate.

48. The method of any one of claims 41 to 47, wherein the Group 2 silicate mineral of step (d) is selected from the group consisting of $CaSiO_3$, $MgSiO_3$, olivine, serpentine, sepiolite, enstatite, diopside, tremolite, and combinations thereof.

49. The method of any one of claims 41 to 48 wherein the Group 2 silicate further comprises mineralized iron and/or manganese.

50. The method according to any one of claims 34 to 46, wherein step (b) further comprises admixing $CaCl_2$ and water to the second admixture.