CLAIMS

1. A method of producing a hydrated magnesium carbonate based cement composite, the method comprising:

mixing an aqueous solution comprising a hydration agent with hydrated magnesium carbonate seed particles to disperse the hydrated magnesium carbonate seed particles throughout the aqueous solution, wherein the hydrated magnesium carbonate seed particles comprise an amount in the range of more than 0 wt% and up to 1 wt%, wherein the wt% is based on the hydrated magnesium carbonate seed particles and a magnesium oxide based cement to be contacted with the aqueous solution;

contacting the aqueous solution with the magnesium oxide based cement to form magnesium hydroxide (i) from the hydration agent and the magnesium oxide based cement, and (ii) on the hydrated magnesium carbonate seed particles; and

exposing the magnesium hydroxide to carbon dioxide to form the hydrated magnesium carbonate based cement composite.

2. The method according to claim 1, wherein mixing the aqueous solution comprises mixing the hydration agent with water before adding the hydrated magnesium carbonate seed particles.

3. The method according to claim 1 or 2, wherein mixing the aqueous solution comprises mixing the hydration agent with water to form a concentration ranging from more than 0 M to 0.1 M.

4. The method according to any one of claims 1 to 3, wherein the hydration agent comprises hydrochloric acid, magnesium acetate or magnesium chloride.

5. The method according to any one of claims 1 to 4, wherein the hydrated magnesium carbonate seed particles comprise $MgCO_3 \cdot 3H_2O$, $MgCO_3 \cdot Mg(OH)_2 \cdot 3H_2O$, $(MgCO_3)_4 \cdot Mg(OH)_2 \cdot 4H_2O$ or $(MgCO_3)_4 \cdot Mg(OH)_2 \cdot 5H_2O$.

6. The method according to any one of claims 1 to 5, wherein contacting the aqueous solution with the magnesium oxide based cement comprises contacting the hydration agent with the magnesium oxide based cement at a mass ratio from 0.55:1 to 0.7:1.

7. The method according to any one of claims 1 to 6, wherein contacting the aqueous solution with the magnesium oxide based cement comprises disposing the hydrated magnesium carbonate seed particles within a plurality of pores of the magnesium oxide based cement.

8. The method according to any one of claims 1 to 7, wherein the magnesium hydroxide formed (ii) on the hydrated magnesium carbonate seed particles is disposed within the plurality of pores and away from the magnesium oxide based cement.

9. The method according to any one of claims 1 to 8, wherein exposing the magnesium hydroxide to carbon dioxide comprises subjecting the magnesium hydroxide to 0.04 vol% to 10 vol% carbon dioxide at 25°C to 35°C and a relative humidity of 75% to 85% for 24 hours or more.

10. The method according to any one of claims 1 to 8, wherein exposing the magnesium hydroxide to carbon dioxide comprises subjecting the magnesium hydroxide to 0.04 vol% carbon dioxide at 60°C and a relative humidity of 75% to 85% for 1 to 2 days.

11. The method according to claim 10, further comprising subjecting the magnesium hydroxide to 10 vol% carbon dioxide at 30°C and a relative humidity of 75% to 85% for a total carbon dioxide exposure period not exceeding 28 days.

12. The method according to any one of claims 1 to 11, wherein the hydrated magnesium carbonate based cement composite comprises magnesium oxide.

13. A hydrated magnesium carbonate based cement composite obtained by the method according to any one of claims 1 to 12, wherein the hydrated magnesium carbonate based cement composite comprises hydrated magnesium carbonate formed from a magnesium oxide based cement and hydrated magnesium carbonate seed particles, and wherein the hydrated magnesium carbonate seed particles comprise an amount of more than 0 wt% and up to 1 wt% of the magnesium oxide based cement and the hydrated magnesium carbonate seed particles to render a denser microstructure in the hydrated magnesium carbonate based cement composite.

14. The hydrated magnesium carbonate based cement composite according to claim 13, wherein the hydrated magnesium carbonate seed particles are disposed in a plurality of pores within the hydrated magnesium carbonate based cement composite.

15. The hydrated magnesium carbonate based cement composite according to claim 13 or 14, wherein the hydrated magnesium carbonate is formed as particles comprising an elongated shape, and wherein the particles are disposed on the hydrated magnesium carbonate seed particles.

16. The hydrated magnesium carbonate based cement composite according to any one of claims 13 to 15, wherein each of the hydrated magnesium carbonate seed particles comprises a diameter of 1 μm to 7 μm.

17. The hydrated magnesium carbonate based cement composite according to any one of claims 13 to 16, further comprising hydrated magnesium carbonate formed as a layered structure or a plated structure.

18. The hydrated magnesium carbonate based cement composite according to any one of claims 13 to 17, wherein the hydrated magnesium carbonate comprises $MgCO_3 \cdot 3H_2O$, $MgCO_3 \cdot Mg(OH)_2 \cdot 3H_2O$, $(MgCO_3)_4 \cdot Mg(OH)_2 \cdot 4H_2O$ or $(MgCO_3)_4 \cdot Mg(OH)_2 \cdot 5H_2O$.

19. The hydrated magnesium carbonate based cement composite according to any one of claims 13 to 18, wherein the hydrated magnesium carbonate seed particles comprise $MgCO_3 \cdot 3H_2O$, $MgCO_3 \cdot Mg(OH)_2 \cdot 3H_2O$, $(MgCO_3)_4 \cdot Mg(OH)_2 \cdot 4H_2O$ or $(MgCO_3)_4 \cdot Mg(OH)_2 \cdot 5H_2O$.

20. The hydrated magnesium carbonate based cement composite according to any one of claims 13 to 19, wherein the hydrated magnesium carbonate based cement composite comprises magnesium oxide.