Claims

1. A method for curing cementitious articles, the method comprising:

providing a cementitious article formed from a mixture of a cement binder, aggregate, and water, the cement binder comprising Ca_3SiO_5;

placing the cementitious article in a curing chamber;

maintaining a curing relative humidity between about 40% and about 80% within the curing chamber;

maintaining a curing temperature between about 50°C and about 80°C within the curing chamber;

curing the cementitious article by flowing a mixture of dry steam and CO_2 into the curing chamber while maintaining the curing relative humidity and the curing temperature for a duration between about 4 hours and about 24 hours, wherein

a concentration of CO_2 in the mixture of dry steam and CO_2 is between about 2.5% and about 20.0%, by volume,

$Ca(OH)_2$ is formed by at least one of the reactions

$2Ca_3SiO_5(s) + 7H_2O(l) \rightarrow 3CaO{\cdot}2SiO_2{\cdot}4H_2O(s) + 3Ca(OH)_2(s)$, and

$2Ca_3SiO_5(s) + 7H_2O(g) \rightarrow 3CaO{\cdot}2SiO_2{\cdot}4H_2O(s) + 3Ca(OH)_2(s)$,

CO_2 from the mixture of dry steam and CO_2 reacts with the cementitious article to form $CaCO_3$ in the cementitious article by at least one of the reactions

$2Ca_3SiO_5(s) + 3CO_2(g) + 4H_2O(l) \rightarrow 3CaO{\cdot}\ 2SiO_2{\cdot}4H_2O(s) + 3CaCO_3(s)$,

and $Ca(OH)_2(s) + CO_2(g) \rightarrow CaCO_3(s) + H_2O(l)$, and

the cured cementitious article comprises a CO_2 uptake equal to or greater than 15%, by weight.

2. The method of claim 1, wherein flowing the mixture of dry steam and CO_2 into the curing chamber comprises flowing dry steam into the curing chamber through a first inlet and flowing pure CO_2 into the curing chamber through a second inlet that is different than the first inlet, and flowing of the dry steam through the first inlet and flowing of the CO_2 through the second inlet maintains the concentration of CO_2 between about 2.5% and about 20.0%, by volume, in the curing chamber.

3. The method of claim 1 or 2, wherein the concentration of CO_2 in the mixture of dry steam and CO_2 flowing into the curing chamber is between about 5% and about 10%, by volume.

4. The method of claim 1, wherein the curing relative humidity is between about 50% and about 70%.

5. The method of claim 1, wherein the curing temperature is between about 50°C and about 70°C.

6. The method of claim 1, wherein the cementitious article is cured in the curing chamber for a duration between about 4 hours and about 16 hours.

7. The method of claim 1, wherein the cementitious article is cured in the curing chamber between about 6 hours and about 10 hours.

8. The method of claim 1, wherein the cured cementitious article comprises greater than or equal to 20%, by weight, CO_2 uptake.

9. The method of claim 1, wherein the cured cementitious article comprises greater than or equal to 25%, by weight, CO_2 uptake.

10. The method of claim 1, further comprising curing the cementitious article in air prior to curing the cementitious article in the curing chamber for a duration between about 1 hour and about 4 hours.

11. The method of claim 1, further comprising air curing and water spraying the cementitious article after curing the cementitious article in the curing chamber.

12. The method of claim 11, further comprising air curing the cementitious article after air curing and water spraying the cementitious article.

13. The method of claim 1 comprising:

maintaining the curing relative humidity between about 50% and about 70% within the curing chamber; and

maintaining a curing temperature between about 50°C and about 70°C within the curing chamber.