SUMMARY

[0003a] In an aspect of the present disclosure, there is provided a lime-based composition, comprising:

lime particles comprising calcium hydroxide and/or calcium oxide;

pozzolan particles comprising silicon dioxide and/or aluminum dioxide, wherein at least 90% of the lime particles and pozzolan particles are less than 75 microns; and

an admixture,

wherein, when the composition is mixed with cement to form a cement blend, calcium aluminum sulfate forms within 28 days.

[0003b] In another aspect of the present disclosure, there is provided a lime-based composition, comprising:

lime particles comprising calcium hydroxide and/or calcium oxide;

pozzolan particles comprising silicon dioxide and/or aluminum dioxide, wherein at least 90% of the lime particles and pozzolan particles are less than 75 microns; and

an admixture,

wherein, when the composition is mixed with cement to form a cement blend, the cement blend has a Strength Activity Index (SAI) of at least 90% within 7 days of mixing.

[0003c] In a further aspect of the present disclosure, there is provided a method of forming a cement blend, the method comprising:

blending (i) lime particles comprising calcium hydroxide and/or calcium oxide, (ii) pozzolan particles comprising silicon dioxide and/or aluminum dioxide, (iii) an admixture, and (iv) cement; and

forming calcium aluminum sulfate within a predetermined amount of time since blending.

[0003d] In another aspect of the present disclosure, there is provided a lime-based cement blend paste, comprising:

a cement blend comprising cement and a lime-based cement extender composition, wherein the lime-based cement extender composition comprises:

a calcium oxide concentration of 45–65%;

a magnesium oxide concentration of 0.5–2%;

an iron oxide concentration of 0.5–2%;

an aluminum oxide concentration of 2–8%;

a silicon dioxide concentration of 20–40%;

a potassium oxide concentration of 20,000–30,000 ppm;

a sodium oxide concentration of 10,000–20,000 ppm; and

an admixture configured to promote reactions between the calcium oxide and at least one of the aluminum oxide or silicon dioxide; and

water, wherein a quantity of the water is determined based on a water-to-cement blend weight ratio corresponding to a predetermined concrete wet density of the lime-based cement blend paste.

BRIEF DESCRIPTION OF THE DRAWINGS

[0004] Features, aspects, and advantages of the presently disclosed technology may be better understood with regard to the following drawings.

[0005] FIG. 1 is a schematic block diagram of a system for manufacturing lime-based compositions, in accordance with embodiments of the present technology.

[0006] FIG. 2 is a flow diagram of a method for producing lime-based compositions, in accordance with embodiments of the present technology.

[0007] FIG. 3A illustrates the relationship between UCS and varying amounts of quicklime, in accordance with embodiments of the present technology.

[0008] FIG. 3B illustrates the relationship between UCS and varying amounts of limestone, in accordance with embodiments of the present technology.

[0009] FIG. 3C illustrates the relationship between UCS and varying amounts of pozzolan, in accordance with embodiments of the present technology.

[0010] FIG. 4A illustrates the UCS of various concrete cylinders without admixtures over time, in accordance with embodiments of the present technology.

[0011] FIG. 4B illustrates the UCS of various concrete cylinders with admixtures over time, in accordance with embodiments of the present technology.

[0012] FIGS. 4C–4E illustrate the Strength Activity Index (SAI) of various types of concrete cylinder over time, in accordance with embodiments of the present technology.

[0013] FIG. 5 illustrates how concrete wet densities of various types of cement blend pastes vary with different water-to-cement blend ratios, in accordance with embodiments of the present technology.

[0014] A person skilled in the relevant art will understand that the features shown in the drawings are for purposes of illustration, and variations, including different and/or additional features and arrangements thereof, are possible.

DETAILED DESCRIPTION

I. Overview

[0015] Embodiments of the present technology relate to combining lime, calcium carbonate, pozzolans, and/or an admixture to produce a lime-based binder or cement extender