[0025] Accordingly, there is still a need for a convenient and economic method of manufacturing a glassy cementitious reagent from globally abundant feedstocks.

[0026] There is also a need to minimize energy consumption and cope with very high and variable melt viscosity without requiring fluxes.

[0027] There is also a need for methods of producing microspheroidal glassy particles and for apparatuses and systems useful for producing such microspheroidal glassy particles.

[0028] The present invention addresses these needs and other needs as it will be apparent from review of the disclosure and description of the features of the invention hereinafter.

SUMMARY

[029a] In one aspect of the present disclosure, there is provided a method for producing a cementitious reagent from aluminosilicate materials, comprising the steps of:

providing a solid aluminosilicate material;

milling the solid aluminosilicate material to have a particle size distribution with D[3,2] of less than 20μm;

melting, by in-flight melting, of the aluminosilicate material in a kiln; and

quenching, by in-flight quenching, of the aluminosilicate material to produce solid microspheroidal glassy particles.

[0029] Examples relate to, among other things, an alternative cement material (ACM), which in some examples comprises a solid microspheroidal glassy particles comprising one or more of the following properties: mean roundness (R) > 0.8 ; and less than about 40% particles having angular morphology (R < 0.7).

[0030] In some examples, the particles comprise a mean roundness (R) of at least 0.9. In examples, less than about 30% particles, or less than about 25% particles, or less than about 20% particles, or less than about 15% particles, or less than about 10% particles have an angular morphology (R < 0.7).

[0031] In some examples, the particles comprise the mean oxide Formula 1: $(CaO,MgO)a•(Na_2O,K_2O)b•(Al_2O_3,Fe_2O_3)c•(SiO_2)d$ [Formula 1]; wherein a is about 0 to about 4, b is about 0.1 to about 1, c is 1, and d is about 1 to about 20.

CLAIMS

WHAT IS CLAIMED IS:

1. A method for producing a cementitious reagent from aluminosilicate materials, comprising the steps of:

providing a solid aluminosilicate material;

milling the solid aluminosilicate material to have a particle size distribution with D[3,2] of less than 20μm;

melting, by in-flight melting, of the aluminosilicate material in a kiln; and

quenching, by in-flight quenching, of the aluminosilicate material to produce solid microspheroidal glassy particles.

2. The method of claim 1, wherein the solid microspheroidal glassy particles having a mean roundness (R) of at least 0.8.

3. The method of claim 1, wherein the cementitious reagent has a molar composition ratios of $(Ca,Mg)_{0\text{-}12}\bullet(Na,K)_{0.05\text{-}1}\bullet(Al, Fe^{3+})_{1}\bullet Si_{1\text{-}20}$.

4. The method of claim 1, further comprising controlling an in-flight quenching profile to produce the solid microspheroidal glassy particles that are greater than 80% X-ray amorphous.

5. The method of claim 1, further comprising the step of adjusting composition of the aluminosilicate material to modify a content of one or more of the elements Ca, Na, K, Al, Fe, and Si.

6. The method of claim 1, further comprising the step of locating the kiln at an aggregate quarry.

7. The method of claim 1, further comprising the step of locating the kiln at a concrete batch plant.