CLAIMS

1. Method of manufacturing a lightweight concrete, the method comprising

a) providing ash obtained from incineration of waste, the ash comprising at least about 0.1 wt% metallic aluminum;

b) mixing the ash with a binder to form a mixture; and

c) curing the mixture to obtain the lightweight concrete,

wherein the ash is derived from bottom ash of a solid waste incinerator facility, and providing ash obtained from incineration of waste comprises reducing particle size of the ash to an average particle size of about 500 μm or less.

2. Method according to claim 1, wherein the average particle size is about 20 μm to about 40 μm.

3. Method according to claim 1 or 2, wherein reducing particle size of the ash is carried out by ball milling.

4. Method according to any one of claims 1 to 3, wherein providing ash obtained from incineration of waste further comprises drying the ash.

5. Method according to any one of claims 1 to 4, wherein the binder is selected from the group consisting of a hydraulic cement binder and an inorganic polymer binder.

6. Method according to any one of claims 1 to 5, wherein the binder comprises or consists of a hydraulic cement binder.

7. Method according to claim 6, wherein the hydraulic cement binder is selected from the group consisting of Portland cement, blended Portland cement, expansive cement, rapid setting and hardening cement, calcium aluminate cement, magnesium phosphate, and mixtures thereof.

8. Method according to claim 6 or 7, wherein the hydraulic cement binder comprises or consists of Type I Portland cement.

9. Method according to any one of claims 6 to 8, wherein mixing the ash with a binder comprises adding at least one of a pozzolanic admixture, water, lime, alkali, and a set-control admixture to the mixture.

10. Method according to claim 9, wherein the pozzolanic admixture is selected from the group consisting of fly ash, silica fume, ground granulated blast-furnace slag, and combinations thereof.

11. Method according to claim 9 or 10, wherein ratio of water to the binder is in the range of about 0.2 to about 1 by weight.

12. Method according to any one of claims 9 to 11, wherein ratio of water to the binder is in the range of about 0.35 to about 0.7 by weight.

13. Method according to any one of claims 9 to 12, wherein the lime comprises or consists of an alkaline earth metal carbonate.

14. Method according to any one of claims 9 to 13, wherein the lime comprises or consists of at least one of magnesium carbonate and calcium carbonate.

15. Method according to any one of claims 9 to 14, wherein the alkali is selected from the group consisting of an alkali metal hydroxide, an alkaline earth metal hydroxide, ammonium hydroxide, and combinations thereof.

16. Method according to any one of claims 9 to 15, wherein the alkali is selected from the group consisting of sodium hydroxide, potassium hydroxide, calcium hydroxide, magnesium hydroxide, sodium carbonate, and combinations thereof.

17. Method according to any one of claims 9 to 16, wherein the alkali comprises or consists of sodium hydroxide.

18. Method according to any one of claims 9 to 17, wherein concentration of hydroxide in the mixture is 100 mol/L or less.

19. Method according to any one of claims 9 to 18, wherein the set-control admixture is selected from the group consisting of gypsum, anhydrite, and combinations thereof.

20. Method according to any one of claims 1 to 5, wherein the binder comprises or consists of an inorganic polymer binder.

21. Method according to claim 20, wherein the inorganic polymer binder is selected from the group consisting of alkali activated aluminosilicates, geopolymer, alkali activated cement, and mixtures thereof.

22. Method according to claim 20 or 21, wherein the inorganic polymer binder is obtained by reacting an inorganic polymer precursor with an alkaline activator liquid.

23. Method according to claim 22, wherein the inorganic polymer precursor is selected from the group consisting of coal fly ash, metakaoline, waste incinerator ash, ground granulated blast-furnace slag, and combinations thereof.

24. Method according to claim 22 or 23, wherein the alkaline activator liquid comprises a silicate and/or a hydroxide selected from the group consisting of an alkali metal hydroxide, an alkaline earth metal hydroxide, ammonium hydroxide, and combinations thereof.

25. Method according to claim 24, wherein the silicate comprises or consists of an alkali metal silicate.

26. Method according to claim 24 or 25, wherein the silicate comprises or consists of sodium silicate.

27. Method according to any one of claims 24 to 26, wherein the hydroxide comprises or consists of an alkali metal hydroxide.

28. Method according to any one of claims 24 to 27, wherein the hydroxide comprises or consists of sodium hydroxide.

29. Method according to any one of claims 24 to 28, wherein concentration of hydroxide in the alkaline activator liquid is at least 1 mol/L.

30. Method according to any one of claims 24 to 29, wherein ratio of hydroxide to silicate is in the range of about 0.2 to about 3 by weight.

31. Method according to any one of claims 24 to 30, wherein the alkaline activator liquid is an aqueous solution of the silicate and/or the hydroxide.

32. Method according to any one of claims 22 to 31, wherein ratio of alkaline activator liquid to the inorganic polymer binder is in the range of about 0.3 to about 2 by weight.

33. Method according to any one of claims 1 to 32, wherein ratio of ash to binder in the mixture is in the range of about 0.01 to about 100 by weight.

34. Method according to any one of claims 1 to 33, wherein mixing the ash with a binder comprises adding at least one of a viscosity control agent, a water reducing agent, and aggregates to the mixture.

35. Method according to claim 34, wherein the viscosity control agent is selected from the group consisting of methylcellulose, polyvinyl alcohol, starch, and combinations thereof.

36. Method according to claim 34 or 35, wherein ratio of the viscosity control agent to the binder is not more than 0.05 by weight.

37. Method according to any one of claims 34 to 36, wherein the water reducing agent is selected from the group consisting of carboxylated polymer, gypsum, anhydrite, and mixtures thereof.

38. Method according to any one of claims 34 to 37, wherein ratio of the water reducing agent to the binder is in the range of about 0.001 to about 0.002 by weight.

39. Method according to any one of claims 34 to 38, wherein the aggregates comprise coarse aggregates selected from the group consisting of gravel, crushed rock, slag aggregate, recycled aggregate, crushed quartz, granite, gneiss, basalt, limestone, and combinations thereof.

40. Method according to any one of claims 34 to 39, wherein the aggregates comprise fine aggregates selected from the group consisting of sand, fly ash, silica fume, artificial light weight fine aggregate, and combinations thereof.

41. Method according to any one of claims 1 to 40, wherein curing the mixture to obtain the lightweight concrete is carried out at a temperature in the range of about 20 °C to about 80 °C.

42. Method according to any one of claims 1 to 41, wherein curing the mixture to obtain the lightweight concrete is carried out at a temperature in the range of about 75 °C to about 80 °C.

43. Lightweight concrete manufactured by a method according to any one of claims 1 to 42.