CLAIMS

What is claimed is:

1. An acid gas absorption composition comprising calcium oxide, the composition comprising:

(a) a specific surface area from 40-100 m^2/g;

(b) a porous volume from 0.25-0.50 cm^3/g of pores having a diameter up to 1200 Angstroms;

(c) more than 40% by weight of the composition of pores having a diameter from 100-400 Angstroms; and

(d) an acid gas mass absorption capacity of at least 4.5 grams acid gas per 100 grams composition.

2. The composition of claim 1 wherein the composition comprises:

(a) 40-80% by weight of the composition of pores having a diameter from 100-400 Angstroms;

(b) wherein the acid gas mass absorption capacity is 4.5-6 grams acid gas per 100 grams composition;

(c) a relative sulfur absorption capacity of at least 3 relative to calcium hydroxide; and

(d) at least 25% reduction in SO_2 and/or SO_3 emissions relative to emissions observed without the use of the composition, when the acid gas comprise SO_2 and/or SO_3.

3. The composition of claim 1 comprising, based on total weight of the composition, 5-95% calcium oxide and a balance of residual impurities.

4. The composition of claim 1 substantially free from calcium hydroxide.

5. The composition of claim 1 comprising calcium hydroxide having a specific surface area from 25-55 m^2/g and a porous volume of less than 0.25 cm^3/g within a pore diameter range up to 1200 Angstroms.

6. The composition of claim 1 comprising a mixture comprising a first fraction of particles having a size of less than 32 micrometers and a second fraction of particles of a size greater than 32 micrometers, wherein the weight percent of the first fraction is at least 90 weight percent, based on the total weight of the mixture.

7. A method of preparing an acid gas absorption composition, the method comprising:

(a) hydrating a starting material to generate an intermediate material comprising calcium hydroxide and having a residual moisture content from 18-27% by weight of the intermediate material,

wherein the starting material comprises calcium oxide characterized by a size less than 10 mm, a reactivity to water less than 40°C/min;

(b) drying the intermediate material to a residual moisture content of less than 2% by weight of the intermediate material, wherein the calcium hydroxide is characterized by a specific surface area of 25-55 m^2/g and a porous volume less than 0.25 cm^3/g;

(c) milling the intermediate material to at least 90% by weight of the mixture having a size of less than 32 micrometers; and

(d) contacting at least a portion of the intermediate material and a heated gaseous stream for a time sufficient to heat the intermediate material to 400-510°C to generate the composition,

wherein the composition is characterized by a specific surface area from 40-100 m^2/g, a porous volume from 0.25-0.50 cm^3/g of pores having a diameter up to 1200 Angstroms, more than 40% by weight of the composition of pores with a diameter from 100-400 Angstroms, and an acid gas mass absorption capacity of at least 4.5 grams acid gas per 100 grams composition.

8. The method of claim 7 comprising simultaneously drying and milling the intermediate material.

9. The method of claim 7 comprising injecting the composition into a flue duct carrying a flue gas.

10. The method of claim 7,

(a) wherein the gaseous stream is from 390-510°C, and preferably 400-425°C; and

(b) wherein the gaseous stream is air or an inert gas.

11. A method of absorbing an acid gas from a flue gas the method comprising:

(a) injecting the acid gas absorption composition of claim 1 into a flue duct carrying the flue gas;

(b) reacting the composition with the acid gas in the flue gas to generate a reaction product including at least one of a calcium sulfate, a calcium sulfite, and a calcium chloride, and thereby reducing the concentration of acid gas in the flue gas.

12. The method of claim 11, wherein the composition is characterized by a removal efficiency on a (sorbent mass / acid gas inlet mass) basis up to 10.

13. The method of claim 11, wherein an injection rate of the composition is less than 16,000 lbs/hr.

14. The method of claim 11, wherein reacting the composition with HCl, SO_2 and/or SO_3 in the flue gas reduces HCl, SO_2 and/or SO_3 emissions by at least 25% when measured against emissions observed without the use of the composition, when the acid gas comprise HCl, SO_2 and/or SO_3.