Claims:

1. A method for producing synthesis gas from biomass, comprising:

grinding a biomass feedstock to produce ground biomass particles;

dispensing the ground biomass particles into thin sheets;

subjecting the thin sheets of ground biomass to a treatment including sequential or concurrent ramps of temperature and pressure shocks; and

recovering a residual non-volatile biomass component from the treatment and reacting the component with at least one of methane, oxygen, steam, and carbon dioxide, at high temperatures.

2. The method of claim 1, wherein the biomass particles are ground to a diameter in the range of .001 inch to 1 inch, and wherein the thin sheets have a thickness that is a multiple of the ground biomass particle diameter.

3. The method of claim 2, wherein the thickness of the thin sheets is between 1 and 30 times the biomass particle diameter.

4. The method of claim 1, wherein the ramps of temperature vary from about 0.001°C/sec to about 1000 °C/sec.

5. The method of claim 4, wherein the ramps of temperature are varied over a period of time ranging from about 1 microsecond to about 1 week.

6. The method of claim 1, wherein the pressure shocks are incremented over a range of pressures.

7. The method of claim 1, wherein the pressure shocks are applied over a range of times varying from about 1 microsecond to about 1 week.

8. The method of claim 1, wherein the pressure shocks vary in magnitude from about 0.2 MPa to about 10 GPa.

9. The method of claim 8, wherein an admixture of pressure shocks of differing magnitudes are applied over a range of times.

10. The method of claim 1, wherein the biomass is subjected to a controlled gas atmosphere or supercritical fluid while being subjected to a temperature ramp.

11. The method of claim 1, in which the biomass is subjected to a controlled gas atmosphere or supercritical fluid while being subjected to pressure shocks.

12. The method of claim 1, wherein the at least one collected gas component is selected from the group consisting of: lipids, furans, hydrocarbons or hydrocarbon fragments, and synthesis gas.

13. The method of claim 1, wherein the temperature ramps include a sufficiently high temperature to create a non-volatile carbonaceous material within the biomass.

14. The method of claim 13, wherein the temperature is above 300°C.

15. The method of claim 1, wherein the pressure shocks increase thermal conductivity of formed non-volatile carbonaceous material within the biomass.

16. The method of claim 1, wherein the non-volatile biomass component reacts sacrificially and catalytically with methane.

17. The method of claim 16, wherein the methane is derived from a wet gas source

18. The method of claim 1, wherein the oxygen is part of a mixture of oxygen and an inert agent, or is derived from the decomposition of an oxygen-containing species, selected from the group consisting of: H_2O, H_2O_2, and N_2O.

19. The method of claim 1, wherein the non-volatile component is activated prior to executing synthesis gas generation reactions.

20. A method for adjusting the ratio of hydrogen to carbon monoxide in synthesis gas, comprising:

grinding a biomass feedstock to produce ground biomass particles having diameters in the range of .001 inch to 1 inch;

dispensing ground biomass into thin sheets having a thickness that is a multiple of the ground biomass particle diameter;

subjecting the ground biomass to sequential or concurrent ramps of temperature and pressure shocks;

selectively collecting various groups of volatile compounds as they are released from the biomass;

collecting a remaining non-volatile component of the thin sheets;

reacting the non-volatile component with one of oxygen, methane, steam, and carbon dioxide; and

adjusting a ratio of reacted oxygen, methane, steam, or carbon dioxide to produce synthesis gas having a hydrogen/carbon ratio in a range of 0 to 100.

Claims

1. A method for producing synthesis gas from biomass, comprising:

subjecting biomass to a treatment including sequential or concurrent ramps of temperature and pressure shocks whereby volatile components and a residual non-volatile biomass component are produced;

recovering the residual non-volatile biomass component from the treatment; and

reacting the component with at least one of methane, oxygen, steam, and carbon dioxide, at high temperatures to obtain a synthesis gas.

2. The method of claim 1, wherein the biomass is ground to particles having a diameter in the range of 0.001 inch to 1 inch, and said particles disposed as thin sheets have a thickness that is a multiple of the ground biomass particle diameter.

3. The method of claim 2, wherein the thickness of the thin sheets is between 1 and 30 times the biomass particle diameter.

4. The method of claim 1, wherein the ramps of temperature vary from about 0.001°C/sec to about 1000 °C/sec.

5. The method of claim 4, wherein the ramps of temperature are varied over a period of time ranging from about 1 microsecond to about 1 week.

6. The method of claim 1, wherein the pressure shocks are incremented over a range of pressures.

7. The method of claim 1, wherein the pressure shocks are applied over a range of times varying from about 1 microsecond to about 1 week.

8. The method of claim 1 , wherein the pressure shocks vary in magnitude from about 0.2 MPa to about 10 GPa.

9. The method of claim 8, wherein an admixture of pressure shocks of differing magnitudes are applied over a range of times.

10. The method of claim 1, wherein the biomass is subjected to a controlled gas atmosphere or supercritical fluid while being subjected to a temperature ramp.

11. The method of claim 1 , in which the biomass is subjected to a controlled gas atmosphere or supercritical fluid while being subjected to pressure shocks.

12. The method of claim 1, wherein the at least one volatile component is selected from the group consisting of: lipids, furans, hydrocarbons or hydrocarbon fragments, and synthesis gas.

13. The method of claim .1 , wherein the temperature ramps include a sufficiently high temperature to create a non-volatile carbonaceous material within the biomass.

14. The method of claim 13, wherein the temperature is above 300°C.

15. The method of claim 1, wherein the pressure shocks increase thermal conductivity of formed non-volatile carbonaceous material within the biomass.

16. The method of claim 1, wherein the non-volatile biomass component reacts sacrificially and catalytically with methane.

17. The method of claim 16. wherein the methane is derived from a wet gas source.

18. The method of claim 16, further comprising at least one of O_2 or H_2O, wherein the reaction conditions are selected to provide a controllable CO concentration.

19. The method of claim 16, further comprising at least one of O_2 or H_2O, wherein the reaction conditions are selected to provide a CO formation rate from reaction with carbon that is greater tha carbon deposition from reaction with methane.

20. The method of claim 1, wherein the oxygen is part of a mixture of oxygen and an inert agent, or is derived from the decomposition of an oxygen-containing species, selected from the group consisting of: H_2O, H_2O_2, and N_2O.

21. The method of claim 1, wherein the non-volatile component is activated prior to executing synthesis gas generation reactions.

22. The method of claim 21, wherein activation comprises heating the non-volatile component to increase surface area.

23. A method for adjusting the ratio of hydrogen to carbon monoxide in synthesis gas, comprising:

subjecting biomass to a heat treatment comprising sequential or concurrent ramps of temperature and pressure shocks;

selectively collecting various groups of volatile compounds as they are released from the biomass;

collecting a remaining non-volatile component from the heat treatment;

reacting the non-volatile component with one of oxygen, methane, steam, and carbon dioxide; and

adjusting a ratio of reacted oxygen, methane, steam, or carbon dioxide to produce synthesis gas having a hydrogen/carbon ratio in a range of 0 to 100.