CLAIMS

1. A method ~~of processing a material, the method~~ comprising:

impinging a substantially inert gas on a first foil window of an electron beam horn while passing electrons through the window and inert gas while processing a cellulosic or lignocellulosic biomass material in particulate form on a conveyor;

while flowing the inert gas through an enclosed space defined by the foil window, which is in communication with a vacuum side of the electron beam horn, and a secondary foil disposed facing the first foil window under flow conditions that maintain the pressure inside the space between about 50 and 200 psi;

treating the inert gas to remove contaminants produced during processing of the biomass material; and

enzymatically saccharifying the processed biomass material to produce a sugar solution.

2. The method of claim 1, wherein the foil has a surface communicating with a high vacuum side of an accelerator tube.

3. The method of claims 1 or 2, wherein the foil, along with a secondary foil, defines a space about which the substantially inert gas traverses.

4. The method of claim 3, wherein the pressure inside the space is greater than atmospheric pressure.

5. The method of any one of the previous claims, wherein the inert gas comprises nitrogen.

6. The method of any one of the previous claims, further comprising recycling the inert gas.

7. The method of claim 6, wherein recycling comprises impinging the substantially inert gas on the foil window more than one time before discarding it.

~~8. The method of any one of the previous claims, further comprising treating the inert gas.~~

~~9~~8. The method of claim ~~8~~1, wherein treating the inert gas comprises filtering the gas.

~~10~~9. The method of claim ~~8 or 9~~1, wherein treating the inert gas comprises removing from the inert gas contaminants selected from oxygen, ozone, oils, particulates, water and mixtures thereof.

~~11. The method of any one of the previous claims, wherein the material is a biomass material.~~

~~12. The method of any one of the previous claims, wherein the material includes a lignocellulosic or cellulosic material.~~

~~13. A system for processing biomass, the system comprising:~~

~~a flow path for providing a substantially inert gas through a space, wherein the space is defined by a first foil in communication with the vacuum side of a scanning horn of an electron beam accelerator and a secondary foil disposed facing the first foil.~~

14. The system of claim 13, wherein the secondary foil is mounted on an enclosure.

15. The system of claims 13 or 14, wherein the flow path includes a first conduit and an inlet for flowing the inert gas into the space and a second conduit and an outlet for flowing the inert gas out of the space, and wherein

the first conduit and second conduit are in fluid communication through the space.

16. The system of claim 15, wherein the first conduit and/or inlet and second conduit and/or outlet are sized so that the pressure inside the space is greater than atmospheric pressure.

17. A method for processing a biomass material, the method comprising;

producing a hazardous gas while reducing the recalcitrance of a biomass material, and

flowing the hazardous gas through a filtering system.

18. The method of claim 17, wherein reducing the recalcitrance of the biomass material occurs in a vault.

19. The method of claim 18, wherein the filtering system is disposed outside of the vault.

20. The method of claim 19, wherein a make-up gas is flowed from the exterior of the vault to the interior of the vault while the hazardous gas is flowed from the interior of the vault to the exterior of the vault and through the filtering system.

21. The method of claim 20, wherein the make-up gas comprises an inert gas.

22. The method of any one of claims 19 through 21, further comprising maintaining a negative pressure in the vault by flowing the gas that is in the vault through the filtering system to the exterior of the vault at a faster flow rate than flowing the make-up gas from the exterior of the vault to the interior of the vault.

23. The method of claim 22, wherein the flow rate to the exterior of the vault is at least 2 times faster than the flow rate to the interior of the vault.

24. The method of claim 22, wherein the flow rate to the exterior of the vault is at least 3 times faster than the flow rate to the interior of the vault.

25. The method of claim 22, wherein the flow rate to the exterior of the vault is at least 4 times faster than the flow rate to the interior of the vault.

26. The method of claim 22, wherein the flow rate to the exterior of the vault is at least 5 times faster than the flow rate to the interior of the vault.

27. The method of claim 22, wherein the flow rate to the exterior of the vault is between about 1000 and 10,000 CFM and the flow rate to the interior of the vault is between about 10 and 5000 CFM.

28. The method of any one of claims 18 through 27, further comprising conveying the biomass from the interior of the vault to the exterior of the vault,

extracting hazardous gases from the biomass, and flowing the hazardous gases through the filter system.

29. The method of any one of claims 17 through 28, wherein the recalcitrance of the biomass material is reduced by exposing the biomass material to ionizing radiation.

30. The method of claim 29, wherein the ionizing radiation is produced by an electron accelerator comprising a scanning horn equipped with a metal foil electron extraction window, and

the method further comprises directing a cooling gas against the extraction side of the foil electron extraction window.

31. The method of any one of claims 17 through 30, wherein the filtering system comprises a carbon filter disposed in the flow of the hazardous gas.

32. The method of any one of claims 17 through 31, wherein the hazardous gas comprises ozone.

33. The method of any one of claims 17 through 32, wherein the hazardous gas comprises volatile organic compounds.

34. The method of any one of claims 17 through 33, further comprising conveying the biomass material while reducing the recalcitrance of the biomass material.

35. The method of any one of claims 17 through 34, wherein the hazardous gas comprises a hazardous component and a non-hazardous component and the filtering system is configured to remove the hazardous component.

36. The method of any one of claims 17 through 35, wherein the hazardous gas comprises a hazardous component and a non-hazardous component and the filtering system is configured to destroy the hazardous component.

37. A system for processing a material in a vault, the system comprising;

a vault containing an electron irradiation device configured to irradiate a biomass material, and

a process gas treating system comprising a gas path that includes a path from the exterior of the vault to the interior of the vault, through the vault, and to the exterior of the vault.

38. The system of claim 37, further comprising a gas filter in the gas path.

39. The system of claim 37 or 38, wherein the gas path through the vault includes a gas path through a window cooling system,

wherein the window cooling system comprises a manifold configured to accept a gas from a conduit and impinging the gas against a first window mounted on the vacuum side of a scan horn of the irradiation device.

40. The system of claim 39, wherein the window cooling system includes a second window facing the first window, wherein the first and second window define a space and the space includes an outlet configured to allow the gas to exit the space.

41. The system of any one of claims 38 through 40, wherein the gas path through the vault includes a path through an intake manifold.

42. The system of any one of claims 38 through 41, wherein the filter is positioned outside of the vault and configured to filter a gas that has flowed through the vault.