

Claims:

1. An apparatus for treating an exhaust gas in a foreline of a substrate processing system, comprising:
 - a plasma source coupled to a foreline of a process chamber;
 - a reagent source coupled to the foreline upstream of the plasma source; and
 - a foreline gas injection kit coupled to the foreline to controllably deliver a gas to the foreline, wherein the foreline injection kit includes:
 - a pressure regulator to set a foreline gas delivery pressure setpoint;
 - and
 - a first pressure gauge coupled to monitor a delivery pressure of the gas upstream of the foreline.
2. The apparatus of claim 1, wherein the foreline gas injection kit further comprises at least one of:
 - a flow control device to provide a known flow of the gas at the pressure setpoint of the pressure regulator; or
 - a control valve to selectively turn on and off the flow of the foreline gas to the foreline.
3. The apparatus of claim 2, wherein the foreline gas injection kit comprises a flow control device to provide a known flow of the gas at the pressure setpoint of the pressure regulator, and wherein the pressure gauge is disposed between the pressure regulator and the flow control device to monitor the delivery pressure of the gas upstream of the flow control device.
4. The apparatus of claim 3, wherein the flow control device comprises at least one of a fixed orifice, a mass flow controller, or a mass flow meter.
5. The apparatus of claim 2, wherein the foreline gas injection kit comprises a control valve to selectively turn on and off the flow of the foreline gas to the foreline, and wherein the control valve comprises a solenoid valve.

6. The apparatus of any of claims 1-2, further comprising:
a second pressure gauge coupled to the foreline to monitor a foreline pressure.
7. The apparatus of claim 6, further comprising:
a controller to control the foreline pressure.
8. The apparatus of claim 7, wherein the controller is programmed to at least one of:
adjust the pressure regulator based on the foreline pressure measured by the second pressure gauge; or
control a flow rate of reagent provided to the foreline by the reagent source and a flow rate of the gas provided by the foreline gas injection kit.
9. The apparatus of claim 6, further comprising:
a vacuum pump having variable pumping capacity coupled to the foreline.
10. The apparatus of claim 9, wherein the controller adjusts the pumping capacity of the vacuum pump based on the foreline pressure measured by the second pressure gauge.
11. A method for treating an exhaust gas in a foreline of a substrate processing system, comprising:
flowing an exhaust gas and a reagent gas into a foreline of a substrate processing system;
forming a plasma from the exhaust gas and reagent gas to convert the exhaust gas to abatable byproduct gases; and
injecting a non-reactive gas into the foreline to maintain a desired pressure in the foreline for conversion of the exhaust gas.
12. The method of claim 11, wherein injecting the non-reactive gas further comprises at least one of:

injecting a first amount of the non-reactive gas in response to a second amount of the reagent gas flowed into the foreline; or

monitoring a pressure level in the foreline and adjusting a flow rate of the non-reactive gas into the foreline in response to the monitored pressure level.

13. The method of any of claims 11-12, further comprising:

flowing a cleaning gas into the foreline to remove material deposited during the conversion of the exhaust gas.

14. The method of claim 13, wherein the material is deposited on one or more of surfaces of the foreline or surfaces of a plasma apparatus disposed in-line with the foreline.

15. The method of 13, wherein flowing the cleaning gas further comprises at least one of:

flowing the cleaning gas between a desired number of process run performed in the substrate processing system; or

flowing the cleaning gas into the foreline from a process chamber coupled to the foreline.

Claims:

1. An apparatus for treating an exhaust gas in an exhaust conduit of a substrate processing system, comprising:
 - a plasma source coupled to an exhaust conduit of a process chamber;
 - a reagent source coupled to the exhaust conduit upstream of the plasma source;
 - and
 - a gas injection kit coupled to the exhaust conduit to controllably deliver a gas to the exhaust conduit to control an exhaust conduit pressure, wherein the gas injection kit includes:
 - a pressure regulator to set a gas delivery pressure setpoint; and
 - a first pressure gauge to monitor a delivery pressure of the gas, wherein the gas injection kit is coupled to the exhaust conduit downstream of the plasma source.
2. The apparatus of claim 1, wherein the gas injection kit further comprises:
 - a flow control device to provide a known flow of the gas at the pressure setpoint of the pressure regulator.
3. The apparatus of claim 2, wherein the pressure gauge is disposed between the pressure regulator and the flow control device to monitor the delivery pressure of the gas upstream of the flow control device.
4. The apparatus of claim 3, wherein the flow control device is a fixed orifice.
5. The apparatus of claim 3, wherein the flow control device comprises a mass flow controller or a mass flow meter.
6. The apparatus of claim 1, wherein the gas injection kit further comprises:
 - a control valve to selectively turn on and off the flow of the gas to the exhaust conduit.

7. The apparatus of claim 6, wherein the control valve comprises a solenoid valve.
8. The apparatus of claim 1, further comprising:
 - a second pressure gauge coupled to the exhaust conduit to monitor a pressure within the exhaust conduit downstream of the plasma source.
9. The apparatus of claim 8, further comprising:
 - a controller to control the pressure.
10. The apparatus of claim 9, wherein the controller adjusts the pressure regulator based on the pressure measured by the second pressure gauge.
11. The apparatus of claim 9, wherein the controller controls a flow rate of reagent provided to the exhaust conduit by the reagent source and a flow rate of the gas provided by the gas injection kit.
12. The apparatus of claim 9, further comprising:
 - a vacuum pump having variable pumping capacity coupled to the exhaust conduit.
13. The apparatus of claim 12, wherein the controller adjusts the pumping capacity of the vacuum pump based on the pressure measured by the second pressure gauge.
14. An apparatus for treating an exhaust gas from a substrate processing system, comprising:
 - a reagent source located downstream of a processing chamber to provide a reagent to a flow of the exhaust gas;
 - a plasma source located downstream of the reagent source to form a plasma from the reagent and the exhaust gas; and
 - a gas injection kit to controllably deliver a gas to control an exhaust gas pressure, wherein the gas injection kit includes:
 - a pressure regulator to set a gas delivery pressure setpoint; and

a first pressure gauge to monitor a delivery pressure of the gas, wherein the gas injection kit is coupled to the exhaust conduit downstream of the plasma source.